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EMPIRICAL STUDIES RELATED TO THE TEACHING OF FRENCH PRONUNCIATION TO AMERICAN STUDENTS.

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THIS REPORT DESCRIBES IN DETAIL FIVE RELATED EXPERIMENTS THAT WERE CONDUCTED IN AREAS PERTAINING TO THE TEACHING OF FRENCH PRONUNCIATION TO NATIVE SPEAKERS OF AMERICAN ENGLISH. THE FIRST TWO EXPERIMENTS SOUGHT TO DETERMINE THE RELATIVE ACCEPTABILITY OF 38 ENGLISH PHONEMES TO NATIVE FRENCH LISTENERS AT EACH OF TWO ACCEPTABILITY LEVELS--PHONEMIC AND PHONETIC. THE THIRD EXPERIMENT ATTEMPTED TO MEASURE THE EXTENT TO WHICH THE PHONETICALLY ACCURATE PRONUNCIATION OF EACH OF 34 FRENCH PHONEMES COULD BE ACQUIRED BY THE AMERICAN STUDENT THROUGH THE SIMPLE REPETITIVE IMITATION OF MODEL SOUNDS. PRELIMINARY SOUND DISCRIMINATION TRAINING OR PRONUNCIATION COACHING WAS DELIBERATELY AVOIDED IN FAVOR OF A SIMPLIFIED BASELINE PROCEDURE OF UNAIDED "SELF-SHAPING." THE FOURTH AND FIFTH EXPERIMENTS COMPARED THE SOUND JUDGING ACCURACY OF INDIGENOUS NATIVE SPEAKERS OF FRENCH TO THAT OF NATIVE FRENCH SPEAKERS FAMILIAR WITH ENGLISH AND TO AMERICAN TEACHERS OF FRENCH WHO HAD LEARNED FRENCH AS A SECOND LANGUAGE. THE RESULTS SUGGESTED THAT INDIVIDUAL DIFFERENCES IN SOUND DISCRIMINATION ABILITY ARE THE MAJOR DETERMINANT IN ACCURATE JUDGING. INCLUDED ARE TABLES, A BIBLIOGRAPHY, AND 13 APPENDIXES OF SOUND LISTS, JUDGING INSTRUCTIONS, AND QUESTIONNAIRES FOR THE FIVE EXPERIMENTS. (AUTHOR/AB)

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Empirical Studies Related to the Teaching of French Pronunciation to American Students

John L. D. Clark

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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Laboratory for Research in Instruction
Harvard Graduate School of Education
Cambridge, Massachusetts
1967

The research reported herein was performed pursuant to a contract with the United States Department of Health, Education, and Welfare, Office of Education (OE 6-14-027).

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Abstract

Five experiments were conducted in areas related to the teaching of French pronunciation to native speakers of American English.

Experiment I sought to determine the extent to which English speech sounds could be considered phonemically acceptable in French. Ten native French speakers listened to 38 English sounds spoken by 10 American speakers and attempted, for each stimulus, to write a French word containing the "same" sound. If no French sound could be suggested, the listener so indicated. Some English vowels (/a /, /i /, /ɛ /, /u /, /e /, /o /) and most consonants or semiconsonants (/m /, /ʃ /, /s /, /n /, /l /, /k /, /p /, /ʒ /, /z /, /v /, /t /, /f /, /w /, /j /) were found to elicit a single "counterpart" French sound with high frequency; a high level of phonemic congruence is suggested for these English sounds and the French equivalents. Other English sounds (/au /, /ɔi /, /ju /, /ai/, /ð̈ /, /θ /, /dʒ /, /tʃ /) were uniformly rejected by the native French judges as not equivalent to any French sound; a third group of English sounds (/U /, /ə /, /æ /, /ɔ/, /I /, /b /, /d /, /g /) evoked diverse French responses, suggesting that phonemic ambiguity would accompany use of these English sounds in French speech situations. In the case of /b /, /d /, and /g /, the incorrect French sounds most frequently chosen were the unvoiced analogs /p /, /t /, and /k /; in this light, it might be possible to raise English /b /, /d /, and /g / to a high level of phonemic acceptability simply through initial instruction in the earlier and more forceful voicing of these consonants. Observed responses to English /h / and /r / were considered

inconclusive as a result of experimental factors.

Experiment II, which comprised both an initial experiment (IIA) and a replication involving slight procedural changes (IIB), tested at the higher level of <u>phonetic</u> acceptability English sounds found in Experiment I to be reasonable phonemic counterparts for French sounds. In both the original and replicated experiments, 30 American speakers pronounced each of 24 English sounds; each production was later combined, in an ABX triplet arrangement, with two "decoy" productions of the corresponding French sound rendered by native French speakers. Twelve native French listeners then attempted to select the non-French sound from among the stimulus triplets: the relative phonetic acceptability of each English sound was defined in terms of the frequency with which the French judges failed to identify the non-French sound. Response figures from the IIB experiment showed that English /a / was significantly less readily discriminated from the corresponding French decoys (that is, more acceptable as "French") than were any of the five remaining vowels (/i /, /ɛ /, /u /, /o /, and /e /). Less salient though statistically significant differences in identification score were also found for certain other vowel groupings. Experimental results for the 18 English consonants tested were affected to a great extent by the judges' discrimination of the carrier vowel /i / which accompanied each consonant; this factor is felt to have contributed in large part to the unrealistically high identification scores and restricted score range obtained. A further study conducted along the same lines but using /ə / as the carrier vowel would be expected to

show much greater differences in acceptability among the English consonants.

Experiment III attempted to measure the extent to which the phonetically accurate pronunciation of each of 34 French phonemes could be acquired by the American student through the simple repetitive imitation of model sounds. Preliminary sound discrimination training or pronunciation coaching was deliberately avoided in favor of a simplified baseline procedure of unaided self-shaping. For each French phoneme, six high school students with no training in French imitated tape recorded model sounds 36 times; this corresponded to approximately 2 1/2 minutes of imitation practice. Student productions were judged by indigenous French judges under an ABX presentation procedure similar to that for Experiment II. Differences in mean identification score for student responses sampled at the beginning, middle, and end of the imitation session were not statistically significant, nor was any consistent improvement over time observed for the imitation of individual sounds. Subsequent aural evaluation by the experimenter of each of the student imitation sequences found that two French vowels (/a /, /ɛ /) and several consonants (/n /, /m /, /s /, /z /, /v /, /j /, /w /) had been well imitated from the outset by all or almost all of the American speakers; this suggests that formal pronunciation instruction for these sounds might be omitted or postponed in favor of increased attention to other sounds. Most of the stimulus sounds were not, however, accurately imitated by the American speakers, either initially or throughout the imitation sequence; for these sounds, the judicious

use of preliminary discrimination training and/or pronunciation coaching techniques would be indicated as a desirable supplement to self-shaping practice.

Experiments IV and V consisted of a rescoring of the Experiment III triplets by two additional groups of judges: 1) native French speakers who had also acquired a very good knowledge of English, and 2) American teachers of French who had learned French as a second language. Scoring results for these two groups were compared to those for the criterion group of indigenous French judges. No significant difference in sound judging accuracy was found among the three groups, although significant differences in judging ability were found among individual judges in each of the groups. These results suggest that individual differences in sound discrimination ability, rather than membership in a particular category of judges, are the major determinant of judging accuracy. Selected background variables drawn from questionnaire data--age, sex, extent of exposure to English/French in school or through travel--were not found to correlate significantly with judging performance. A work-sample test of sound discrimination is suggested as a more effective predictor of judging ability in tasks similar to those represented in the study.

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Introduction

This is a report of five experiments which investigated certain areas of interest in the teaching of French pronunciation to native speakers of American English. The first two experiments were concerned with determining the relative acceptability of English phonemes to native French listeners at each of two acceptability levels: phonemic and phonetic (described below). The third experiment sought to determine the effectiveness of a simple "self-shaping" procedure in teaching the phonetically accurate pronunciation of the French phonemes; the fourth and fifth experiments compared the sound judging accuracy of indigenous native speakers of French to that of French speakers familiar with English and to that of American teachers of French.

All these experiments were conceptually and chronologically related; this introduction will attempt to show this relationship and also to outline the pedagogical concerns which motivated each part of the study.

It is useful to discuss briefly what is meant by the phonemic and phonetic goals of pronunciation learning. The various phonemes of a given language are, technically, not defined in terms of particular articulations; they are defined rather as groups of articulations which may vary considerably in physiological and acoustic characteristics but which share a common function in differentiating linguistic forms for the native speaker of the language. For example, the /p / sound in

the English word pin is usually forcefully aspirated, while the /p / sound in the word spin generally lacks this aspiration. Although the physiological and acoustic characteristics of the two sounds are different, both are perceived by the native speaker as representing the "same" sound with respect to communicative meaning. Similarly, the /k / sound as it appears in such words as king, cup, cool represents three different articulations which are distinguishable on careful listening. Nonetheless, all three productions sound alike to the average native listener in the sense that he intuitively and automatically classifies them as belonging to the general phoneme category /k /: the same linguistic information is conveyed in all three cases.

The various different articulations included within a given phoneme category are usually referred to as the different allophones of that phoneme. The /p / sounds of pin and spin would thus constitute two different allophones of the general phoneme, namely the aspirated /p^h / allophone and the unaspirated /p / allophone. Native speakers, in a given linguistic context, usually produce the proper allophone automatically and unconsciously. However, speakers of some other language may in their attempts to learn the new language produce the wrong allophone for a given context or may even produce an incorrect phoneme. In the latter case, comprehension of the intended message would be at issue: for example, a native speaker of French learning English as a second language might in the early stages of instruction say fin in place of thin, since the sound /θ / does not appear in his native language. In the pronunciation of an incorrect allophone, the French

speaker might pronounce pin with an unaspirated /p /; here, the chance of misinterpretation would probably be slight: although the English listener might feel that there was something odd about the pronunciation, he would have little trouble in placing it in his /p / phoneme category.

In terms of the above discussion, a phonemic level of pronunciation accuracy may be defined as the level at which the learner is able to avoid producing sounds which the native listener would misclassify as belonging to some other phoneme or, possibly, would consider completely foreign to the phonemic system of his language. For example, the native speaker of German operating at a level of phonemic acceptability in English would have learned to voice certain English plosives in word-final position (bud) with sufficient strength so that they would not be misinterpreted by the English listener as the unvoiced analog (but), that is, as a different phoneme from the one intended. Phonemically correct pronunciation would always be comprehensible in that the phonemic categories of the target language would not be violated by the learner.

Even if the learner possesses a phonemically accurate pronunciation of the target language, problems may still exist at the allophonic or "sub-phonemic" level. The American speaker learning Spanish, for example, might pronounce modo or todo with an occlusive /d / rather than the fricative /d / used by native speakers in intervocalic position. Although this pronunciation would probably not confuse the Spanish listener as to the phoneme intended, he would nonetheless be made aware that the pronunciation was not that of a native speaker. Accurate

pronunciation at the phonetic level implies that even such sub-phonemic mistakes are consistently avoided, so that the utterances of the learner are not considered by native listeners to differ from those which would be characteristically produced by native speakers of the language. It should be mentioned that a certain leeway in pronunciation may be allowed even at the phonetic level, since there is some variation among native speakers in the pronunciation of certain sounds (as, for example, individual differences among English speakers in the extent of diphthongization of stressed vowels). It is questionable, however, as to the amount of assistance which this would provide for the non-native learner, since the dimensions along which the native sounds were allowed to vary would not necessarily include any typical productions in the student's own language.[1]

Instructors who set a phonemic pronunciation goal for their language students are thus primarily interested in having the students acquire, for each of the target language sounds, pronunciation of a quality acceptable to native speakers as representing one of the phonemes of their language; the major criterion is that of communicative success, and little emphasis is placed on the correction of the various elements of "foreign accent" which phonemically correct pronunciation may still embody.

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[1] A more detailed exposition of phonemic theory and its relationship to problems of second-language learning may be found in Lado (1957). A comparative analysis of the French and English sound systems is given in Politzer (1960).

A number of factors may be cited in favor of adopting such a goal. First, of course, is the immediate communicative relevance of a phonemic approach: once the student becomes capable of producing the various foreign language sounds, not perhaps with phonetic accuracy but in a manner which can be comprehended by his native auditors, it is immediately possible for him, in a sense, to forget about pronunciation problems and to concentrate on the development of grammatical control, the learning of new vocabulary, and the real-life business of communicating with other speakers of the language.

Second, it is generally accepted that correct pronunciation at a phonemic level is much more easily acquired than is control at a level of phonetic accuracy. Indeed, at least for those languages most commonly taught at the grade school and high school level (French, Spanish, German), it is usually considered possible for the English speaking student to make a direct transfer of certain English phonemes--the so-called "counterpart" sounds--into the foreign system. Considerable instructional time can of course be saved by this transfer of previously acquired skills, in contrast to the more protracted and more detailed work involved in training for phonetic accuracy.

A third advantage of the phonemic goal lies in the relative ease with which the parameters of this goal can be stated and its acquisition measured. Since phonemically accurate pronunciation is by definition pronunciation which is communicatively intelligible to the native listener, rather straightforward and objective means are available to test this intelligibility. A simple pronunciation test at the phonemic

level might, for example, ask the student to pronounce one of a group of words exemplifying some phonemic contrast such as pend, pont, pain; a native listener would report which of these words had been pronounced.

Lado (1957, 1961) has been perhaps the most active proponent of the phonemic approach to language teaching, both in terms of aural comprehension training and speech production; the majority of the testing procedures described in his Language Testing (1961) are objective in nature and involve the recognition or production of phonemically accurate speech. Lado summarizes his interest in the phonemic criterion as follows:

"Testing promunciation with a phonemic criterion of accuracy is the new thing. It is defensible because it makes possible and practicable a communication point of view, because it permits certain new techniques [in testing]...and because it permits more accurate scoring by teachers of the language and by native speakers. Tests of phonetic accuracy beyond the phonemic criterion that has already proved highly productive require specialized phonetic training that is not within the scope of this book to attempt" (1961, pp. 40-41).

Politzer (1954) cites similar advantages of the phonemic approach; he also emphasizes the role of contrastive analysis in establishing counterpart sounds in the two languages and conversely, in predicting areas of non-agreement which can be expected to require conscious learning on the part of the student.

Certain criticisms of the phonemic goal, or more accurately, of limiting pronunciation instruction to the phonemic level, may be

advanced. First, phonemically accurate speech by non-natives is by no means necessarily pleasing to native listeners: depending on the mispronunciations involved and on the cultural aspects of the communication situation, native listeners may be pleasantly affected or considerably irritated. This consideration has led Marty (1960) to define a "satisfactory" foreign language pronunciation as one which "can be readily understood by a native without annoyance" (p. 230; italics added).

Although there may be general agreement among foreign language teachers that a particular mispronunciation will usually be badly received by native listeners (the American /r /, for example, when used in speaking French), there seem to have been no controlled experimental studies on the positive or negative reception of certain types of foreign accent by native listeners, or of native reaction to the mispronunciation of certain sounds; thus, statements about the "annoyance" attending non-phonetic pronunciation must be somewhat conjectural.

A strong argument in favor of adopting a phonetic rather than a phonemic goal is the obvious fact that this is the only way in which native linguistic performance can be approached. Those students who for whatever reason (general culture, travel or work abroad) seek a natively accurate pronunciation of the target language will not find their needs met in a school program overtly or implicitly limited to a phonemic command.

A second factor favoring the establishment of a phonetic goal is

that this goal automatically subsumes the phonemic goal: since phonetically accurate speech is necessarily accurate phonemically, both levels of performance are taken into account in a course of instruction designed to teach phonetically accurate pronunciation. The possibility of bypassing the overt initial teaching of phonemic control by dealing from the start with phonetic accuracy may be considered appealing.

A negative consideration which must be raised in connection with the phonetic approach is the possible interference which such an approach would have on student accomplishment in other areas, especially in the development of general speaking fluency. If, as is often the case, instruction in the phonetically accurate pronunciation of the different sounds is taken up in a predetermined (and for the most part conventional) order, the student must, in effect, wait until a given sound comes up for discussion and drill before he can make effective use of it in speech. In such cases, growth in fluency may have to wait upon the necessarily slower business of teaching the various individual sounds to a criterion of phonetic or near-phonetic accuracy.

It may, on the other hand, be possible to argue that extensive speaking practice by students who have acquired only a phonemic command of the sound system would prove detrimental to the later acquisition of phonetic accuracy. The possibility of "negative transfer" through the habitual use of phonetically incorrect (viz., transferred English) sounds in French speech situations is a research question which does

not yet appear to have been experimentally addressed.

A third approach to the establishment of pronunciation goals, and one which appears to have been adopted to a large extent in recent teaching manuals and other teacher-oriented materials (such as those mentioned below), attempts to combine both phonemic and phonetic considerations. This approach, which might be called the "phonemic-plus" technique, specifies as a minimum immediate requirement training in the phonemically accurate production of all the foreign language sounds; beyond this, it seeks a fairly early command at the phonetic level of target language sounds which by virtue of their frequency of occurrence in the target language, the seriousness of their mispronunciation by students, or both, are considered to merit special attention.

Stockwell and Bowen (1965), in their contrastive analysis of English-Spanish phonology, provide lists of sounds whose "mispronunciation by English influence can cause misunderstanding," followed by lists of sounds whose mispronunciation "results in a heavy foreign accent." The authors advocate careful preliminary teaching of all the necessary phonemic distinctions, followed by work on the listed phonetic problems, which "move into critical focus after the first priorities have begun to be mastered--or have at least been brought thoroughly into the student's awareness" (p. 55).

Politzer (1965) defines the phonemic and phonetic levels of pronunciation success and gives lists (for French, Spanish and German) of phonemically troublesome target language sounds, "sounds that are

so different from English you do not have any acceptable (in the sense of comprehensible) substitute sounds" (p. 97), followed by groups of sounds whose English counterparts, when used by an English speaker, "are the least acceptable to the native speaker and are the most obvious and objectionable mark of a strong English accent" (p. 97). In a recent phonetics manual for teachers, Pierre and Monique Léon (1964) advocate as an initial procedure the teaching of phonemic contrasts; after this "stade de minimum nécessaire à la compréhension" (p. 4) is reached, problems relating to the correction of foreign accent may be addressed.

It may be suggested that such a "phonemic-plus" approach incorporates the most desirable aspects of both the phonemically and phonetically oriented modes of instruction. By first insuring that phonemically accurate production of the foreign sounds has been learned (or wherever possible, transferred from the student's own language), the teacher provides the student, quite early in the instructional sequence, with the pronunciation tools necessary to communicate effectively in real-life situations.[1] Equipped with a phonemically acceptable pronunciation of the target language sounds, the student is in a position to say whatever his grammatical and lexical competence will allow at any given point in the course. Subsequent training in the phonetically accurate production of those target language sounds

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[1]The assumption is made here that reasonable fluency at a less-than-phonetic pronunciation level would in itself be pedagogically desirable and would have at worst a neutral effect on later acquisition of phonetic accuracy.

whose mispronunciation is considered most serious would most effectively utilize the time available for instruction at this level.

The "phonemic-plus" approach might fail to satisfy instructors of extreme "phonetic" persuasion, especially if a total of relatively few target language sounds were identified as requiring training on a phonetic level. If, however, the intention were ultimately to teach the phonetically accurate pronunciation of all of the target language sounds--beginning, of course, after phonemic accuracy had been assured--even those teachers primarily interested in the level of phonetic control might concede the pedagogical value of a combined approach.

The efficient development of pronunciation teaching programs on a phonemic, phonetic, or "phonemic-plus" basis suggests the undertaking of experimental studies which would seek to provide objective data concerning various working assumptions which have generally been made in these areas. First, on the phonemic level, it would be desirable to determine which of the target language sounds (in the present study, French sounds) have acceptable English counterparts. Although articulatory comparison of the French and English phoneme sets, together with an intuitive or commonsense appreciation of phonemic similarities in the two languages, may point rather easily to certain "equivalent" and "non-equivalent" sounds, an empirical verification of these correspondences would appear to be of value.

It would also be desirable to determine--for any English sounds which are found to be inaccurate or unstable equivalents of French sounds (in the sense that they are identified by native listeners as

corresponding to two or more French phonemes)--the nature and extent of such ambiguity. In this respect, it should be possible to provide a scale of "goodness" or "closeness of correspondence" for the various French-English equivalents, ranging presumably from very close correspondence (complete or virtually complete acceptance of a given English phoneme as similar to a single French phoneme) through moderate correspondence (the English sound predominantly classified as similar to a certain French phoneme but confused to a slight extent with another phoneme or phonemes) and finally, to either outright ambiguity (virtually equal probability of assignment of two or more French phonemes) or patent non-equivalence (where the English sound is frankly rejected as not belonging to the French phoneme set).

Any English phoneme found to have a very close correspondence to a single French sound could, of course, be considered eminently transferable into French: the American student would not have to learn the pronunciation of the corresponding French sound, but could safely and effectively use the English sound in speaking phonemically acceptable French.

At the other extreme, a clear pedagogical problem could be considered to exist where the English sound transfered is found to produce phonemic ambiguity for the French listener, and immediate correction would be indicated in such cases. Presumably, this correction would involve the production of two or more clearly differentiated target language sounds and complete avoidance of the original English sound.[1]

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[1]It would of course still be possible to limit instruction in these novel sounds to the phonemic level, that is, to teach the new sounds only to a criterion of phonemic accuracy.

For sounds lying between these extremes, certain decisions as to instructional precedence would have to be made: although an improved production of all of these sounds might eventually be intended, first attention would probably be given to sounds having a greater functional load in French.

An experiment intending to deal with these questions was conducted as Experiment I of the project; the procedure employed and the obtained results are described in Chapter 1.

Given a number of English sounds which on the basis of experimental results are considered to have valid phonemic equivalents in French, one might raise the additional question as to whether any of these English sounds would be at the same time <u>phonetically</u> equivalent to the counterpart French sounds. For any such sounds, formal instruction in pronunciation could be bypassed at both the phonemic and phonetic levels, with a corresponding saving in classroom or language laboratory time. Although it would be anticipated that most English sounds would not meet a French phonetic criterion, certain consonants (/m /, /n /, /s /, /ʃ /, /z /) as well, possibly, as one or two English vowels (/ɔ /, /ɛ /) might be found closely equivalent, at the phonetic level, to the corresponding French sounds. Even if few or no English sounds phonemically acceptable in French were found to reach this more stringent criterion, the ranking of the sounds along a scale of relative acceptability at the phonetic level could suggest instructional priorities. English sounds found to be open giveaways of a foreign accent (that is, those sounds almost infallibly recognized as

"not French" by native listeners) would be the first to receive attention, while English sounds which were occasionally or perhaps even frequently found to be indistinguishable from real French sounds might be allowed to serve until such time in the course that the more flagrantly non-French sounds had received the necessary attention.[1]

An examination at the phonetic level of English sounds having phonemic counterparts in French was the purpose of Experiment II, which is described in detail in Chapter 2.

Experiment III of the study investigated the utility of a particular method of pronunciation instruction at the phonetic level. This experiment attempted to determine the extent to which each of the French phonemes found in the preceding experiment to represent an instructional problem for English speakers at the phonetic level could be taught to a criterion of phonetic accuracy through the simple expedient of the untutored repetitive imitation of model sounds. Such a "self-shaping" procedure may be considered among the simplest and most easily implemented procedures for the teaching of pronunciation, since it requires no textbook or other visual materials, nor any direct contact with the teacher. Indeed, if the successful self-shaping of certain French sounds were found possible, the teaching of

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[1]It should be noted that this scaling of relative acceptability is not directly based on psychological annoyance factors previously discussed. It is reasonable to assume, however, that a major component of the native speaker's "annoyance" on hearing mispronounced sounds would be their lack of closeness to the native sounds in question.

these sounds might be relegated completely to the language laboratory. On the other hand, those sounds which could not be taught to a phonetic criterion through the use of a self-shaping procedure could be considered valid objects of more extensive teaching methods involving formal classroom instruction, the use of visual materials, or other procedures.

Experiments IV and V (Chapter 4) involved the rescoring of the Experiment III student response materials by two additional groups of judges. Whereas the sound scoring in Experiment III had been done by a "criterion" group of judges--indigenous native speakers of French with whom the American student travelling in France would be expected to have the most frequent contact--judges for Experiment IV consisted of a group of native speakers of French who, through extensive residence in English-speaking countries, marriage to native speakers of English, or for other reasons had also acquired considerable competence in English. By comparing the scoring performance of these two groups of native French listeners, it was hoped to determine whether a substantial knowledge of English on the part of French judges would increase or decrease accuracy in determining non-French pronunciation by American students. If little difference in the scoring performance of indigenous French and "French-English" judges were found, use of listeners of the second type as pronunciation critics (for classroom evaluation, test scoring, or other procedures) could be considered justified. If, on the other hand, there were significant differences in judging accuracy for the two groups, considerable caution would be

suggested in interpreting the responses of French judges familiar with English as valid reflections of the responses which indigenous native speakers would make to the same materials.

Experiment V involved a final rescoring of the Experiment III materials by a group of American teachers of French whose knowledge of French had been acquired on a second-language basis. This experiment attempted to compare the sound judging accuracy of these non-native French teachers to that of the indigenous French and "French-English" listeners. Equal, or possibly even greater, discriminative ability on the part of the American teachers would of course be the preferred result; this would suggest that American teachers of French having a competence at least equal to that of the teachers participating in the study might be considered to have sufficient discriminative ability to detect unacceptable pronunciations on the part of their students. If, however, the teacher group proved significantly less accurate than native French judges in determining the acceptability of the sounds heard, some question might be raised as to the adequacy of their discriminative performance from the point of view of pronunciation teaching.

A final comment should be made concerning the molecular research technique used in these experiments, which involved the production and evaluation of single sounds or syllables[1] rather than longer words or phrases. This approach was in large part dictated by the desire to concentrate on only one phonological element at a time (that is, on a

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[1](In the case of consonants, the sound under examination was necessarily followed by a carrier vowel.)

particular speech sound); in this respect, it was desirable to minimize the possibility of experimental influence by additional contextual factors which would be present in phonologically more complex utterances. From a language teaching standpoint, the discrimination and production of individual sounds, although by no means the whole story of successful foreign language pronunciation, may be considered a valuable initial step in most pronunciation learning endeavors, and as such may provide some practical justification for the emphasis placed on the investigation of single sounds in the present study.

Chapter 1

Phonemic Acceptability of English Sounds in French

Preliminary Discussion

As discussed in the Introduction, the primary purpose of Experiment I was to determine the extent to which each of the English vowel and consonant phonemes could be expected to serve as phonemically acceptable substitutes for French sounds.

Possibly the most straightforward investigative technique in this respect would have been to conduct separate face-to-face interviews with a number of native speakers of French. Under such a procedure, the experimenter would pronounce each of the English phonemes, and the French informants would be asked to give a French word which they felt contained the "same sound" as the one pronounced or to state that no such sound existed in French. Under such a procedure, however, the possibility for the experimenter to accidentally bias the results would be considerable (for example, the interviewer might be tempted to have the informant "think harder" for a sound which the interviewer considered to have an appropriate counterpart). Even if the interview procedure were sufficiently standardized to rule out any such assistance, the subconscious interplay between experimenter and informant would remain a possible factor.

Clearly, a procedure which would not require the presence of a human interviewer would be indicated; this would in turn suggest the

use of a tape recording to administer the stimulus sounds and a similarly automated procedure for obtaining the informants' responses.

An experimental arrangement of this general type was used by Scholes and Trager (1965) who investigated the responses of speakers of different languages[1] to a series of artificially produced vocalic stimuli. In this study, the stimuli were presented to all subjects simultaneously by means of a recording; each subject was provided with a printed list of words exemplifying "permissible" phonemic responses, with two example words given for each phoneme. The English subjects, for example, were given a list showing pat, dash as examples of /æ$_e$/[2], pet, sell as examples of /ɛ$_e$/, and so forth through six different vowel possibilities.[3] After listening to each stimulus, the subject checked one of the word-pairs on the response sheet if he felt that the stimulus sound was "similar" to the vowel sound represented by the word-pair; if the subject felt that the sound heard was not similar to any of the sounds in the example words, he was asked to mark "none."

Although this technique eliminates the possibility of influence

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[1] Spanish, Japanese, Persian, and American English.

[2] Here and elsewhere, the subscript e will denote English sounds and f, French sounds. Subscripts will be omitted in some instances, where the language involved is clearly indicated by the context.

[3] The number of permissible vowels varied between 5 and 6 depending on the language.

by the experimenter, the response-indicating procedure used would not have been practical in the present study. The Scholes-Trager procedure requires the subjects to read (or at least scan) the list of example words before making their response, and although the requirement of considering each of six word pairs in order to mark a response might not be a prohibitive task, the present experiment involved a much larger number of stimulus sounds (a total of 38 different English vowels and consonants), and a correspondingly larger number of response possibilities would have to have been provided. Given such a lengthy response list, it would have been burdensome for the French listeners to locate and mark the "similar" sound for each of the stimuli presented. Indeed, it could be expected that in many cases the listeners would be tempted to mark a "none" response rather than go through the entire list of sounds to find the proper response. Even on the assumption of considerable diligence on the part of the listeners, the constant perusal of a long printed response list might lead to a sort of "verbal satiation" in which the example words would cease to operate as meaningful entities.

One way of avoiding this reading problem would have been to present aurally both the stimulus sound and the response possibilities; the listener would respond simply by circling a letter or number corresponding to the sound selected. This procedure was adopted by Sapon and Carroll (1958): in a study of the differential responding of speakers of different languages[1] to identical auditory stimuli, tape recorded

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[1](Spanish, Japanese, and American English)

stimulus "words" were followed at a short interval by four spoken answer options. One option was identical to the stimulus, and the other three differed in only one phonetic element. An essentially similar procedure was used by Suppes, Crothers, and Weir (1962) in a discrimination training study involving the matching of Russian vowels by American listeners.[1]

Serious consideration was given to the use of this "spoken option" procedure, which has a great advantage of experimental simplicity, objectivity, and ease of scoring. One drawback, however, in the present study, would have been the necessity for the speaker to specify in advance the phonemes from which the subject was to select his response. Rather than formulate initial hypotheses about the French phonemes that the French judges would "hear" in listening to the various English sounds, it seemed preferable, for the purposes of this essentially exploratory study, to allow the native listeners themselves to choose the sounds that they would give as responses.[2]

The experimental procedure finally adopted made use of a standardized tape recording to administer the English stimuli together with a

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[1]The training was carried out by repeating the correct answer after the subjects had made their response; this instructional element was of course not a part of the Sapon-Carroll procedure.

[2]It would, however, be possible as a follow-up study to conduct a forced-choice experiment using as the correct response the most popular response as given by the listeners in the present experiment, and the three next most frequent selections as "distracters."

modified response arrangement which approximated the free interview situation. Under this procedure, the judges listened to a recorded English sound and then determined whether such a sound existed in French, in the sense that they could think of an example French word containing that sound. If so, the judges wrote one such word on their response sheet. If the judges felt that no such sound existed in French and that an example word could not be found, they would so indicate. One assumption in the use of this procedure was that each judge would mentally exhaust the French phoneme inventory before making his response, or perhaps more accurately, would mentally test the sound heard against any reasonable possibilities in his own language. This is, of course, a very reasonable assumption in view of the very great degree of internalization of phonemic structure for native speakers of a given language.

One drawback to this response procedure was the necessity to determine, on an ex post facto basis, the French phoneme intended to be represented by each response, that is, the response sheets would later have to be analyzed. An immediate suggestion to the judges in this respect was that the response words should be kept quite short so as to avoid ambiguity as to the sound intended. This was, of course, in keeping with a natural tendency on the part of the judges to simplify their own experimental task by writing short words.

An additional possibility was to have the judges write an example word and then underline the sound in question; this procedure was not adopted, however, in view of the increased work which this would have

involved for the listeners; this method would also have forced the judges to think in terms of the orthography of certain sounds, which might have been a somewhat distracting factor. Further, since the English sound in question would be known by the person scoring the response sheets, the underlining would in most cases not be particularly helpful. For example, given the written response thé, the intended sound would obviously be /t_f / for a presented English /t / and /e_f / if the sound presented had been English /e / (or some other vowel). As it turned out, there were only very few situations in which it was not possible to identify the intended response on the basis of the words written by the judges.[1]

However, it was decided that as an added safeguard the French listeners would be asked, following the judging session, to read aloud all of the words that they had written. The purpose of this was to check the judges' pronunciation of the sounds, which presumably would correspond to the sounds which they had intended to represent. For certain sounds, this pronunciation procedure did not operate effectively, as will be discussed in connection with the obtained results; for the most part, however, the pronunciations of the judges served as a useful check on the sounds represented by the written words.

Since the intent of Experiment I was to determine the phonemic acceptability of the "basic English speech sounds," an initial task was to define this set of sounds. In the case of English consonants and semiconsonants, there was relatively little question as to the sounds

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[1] See p. 34 for a discussion of the occasional "ambiguous" entries.

involved: consonant inventories given by Bronstein (1960), Gleason (1955), and Kenyon (1935) were compared and found to be essentially similar. There were, however, a few differences among the three lists. Two consonants in the Bronstein list, /ʍ/ (wheeze and /ç/ (huge) are not included in the Gleason inventory; Kenyon lists /ʍ/ but not /ç/. The final consonant-semiconsonant listing adopted for the experiment eliminated these two sounds, as well as a third, /ɲ/, which although common to all three lists, was considered difficult to pronounce by untrained speakers in the single syllable (consonant plus helping vowel) context involved in this and later experiments.[1] With these exceptions, the consonant-semiconsonant inventory for the experiment corresponds to the lists given in the three references cited.

In the case of English vowels, there was somewhat less uniform agreement. The Bronstein list contains 17 simple vowels and 5 "important" diphthongs; Kenyon describes equal numbers of sounds in these two categories, but with some difference in the sounds included (for example, Bronstein cites both a pure and diphthongized /e /, while Kenyon has only the one diphthongized sound. Kenyon, on the other hand, includes a diphthongized /ju / which is not matched in the Bronstein

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[1] In retrospect, the exclusion of /ɲ / was unfortunate, since this sound occupies a definite position in the English phoneme set and would be anticipated to be an at-least-phonemic equivalent of French /ɲ/. A preferable procedure would have been to test the sound in the regular manner with the reservation that the single-syllable pronunciation was probably unfamiliar to the American speakers.

list. The vowel inventory in Gleason is much shorter, and includes a total of 7 pure vowels and 6 diphthongs.

In view of the variability among these vowel inventories, particularly in the treatment of diphthongs and also certain other differences (Bronstein and Kenyon, for example, list the "r-colored" /ɚ/ and /ɝ/, which are not included in Gleason), the decision was made to select on an ad hoc basis those vowel sounds which seemed to be most important in general American speech, taking into account the following considerations: 1) vowels occurring in only a few dialects would not be included; 2) vowels dependent on a particular phonetic environment for their realization, or otherwise considered to be unstable or sporadic would not be included (for example, the "barred I" /ɨ/ of Bronstein's list); 3) pure vowels usually diphthongized in American speech, particularly in stressed position (/e/, /i/, /o/, /u/) would be listed only once rather than separately as in Bronstein;[1] 4) slightly different interpretations of the mid-vowel or schwa would be replaced by a single /ə/ (as in mud).

The final experimental list, consisting of 15 vowels and 18 consonants and semiconsonants, is given in Table 1 together with example words for each. The symbols used generally follow IPA notation, and are intended as broad transcriptions of the sounds involved.

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[1] It was expected that all four of these vowels would be diphthongized in the experimental situation, since they would be pronounced in isolation and hence under single-syllable stress.

Table 1

Experiment I

Inventory of English Sounds Used

Vowels				Consonants			
/a /	a	:	father	/b /	b	:	bulb
/ə /	u	:	upper	/m /	m	:	must
/ɔ /	a	:	saw	/r /	r	:	run
/ju/	you	:	youth	/ð /	th	:	thus
/e /	ay	:	bay	/v /	v	:	Vulcan
/au/	ou	:	mouse	/j /	y	:	young
/ɔi/	oi	:	boil	/l /	l	:	love
/U /	oo	:	good	/k /	c	:	come
/ɛ /	e	:	bet	/n /	n	:	numb
/i /	ee	:	feel	/ʃ /	sh	:	shun
/u /	oo	:	pool	/θ /	th	:	thumb
/ai/	i	:	fight	/h /	h	:	hum
/I /	i	:	lid	/t /	t	:	tummy
/æ/	a	:	man	/z /	z	:	Zundapp
/o /	ow	:	throw	/ʒ /	ge	:	beige
				/f /	f	:	fun
				/dʒ/	j	:	judge
				/p /	p	:	pun
				/tʃ/	ch	:	chum
				/g /	g	:	gum
				/d /	d	:	dud
				/w /	w	:	wonder
				/s /	s	:	gun

Note.--Phonetic symbols were not seen by speakers.

Procedure

Ten different American speakers were asked to pronounce the English sounds for this experiment, on the grounds that a sampling of characteristic productions of each sound could thus be obtained. In this way, experimental results would not be bound to a particular idiolect but could be considered more representative of general English speech.

The speakers used were male college students, all native speakers of English, ranging in age from 19 to 21. All had been born in the United States, and only three of the ten had lived in or visited a foreign country for a period of a month or more. One had been in the Netherlands for two months, another had been in Pakistan for ten months, and a third had been in England on four trips averaging seven months each. According to a questionnaire administered to each speaker (Appendix A), diverse geographical areas were listed as residences; the following were given as the cities or towns where each speaker had lived for the longest period of time: Washington, D.C., Palo Alto, Denver, Knoxville, Cincinnati, Seattle, Indianapolis, Houston, Chicopee, Mass., Ithaca, N.Y., and Concord, N.H.

All of the speakers had studied foreign languages in school, usually French, Spanish, or German; this is not however considered an important factor for purposes of the experiment, since it is felt that study of a foreign language would not reasonably have affected the speakers' pronunciation of English. Further, the speakers were not told the purpose of their activities until after the recordings had

been made, but were simply asked to say a number of English sounds as they would be pronounced in common English words.

All speakers were by self report free of speech or hearing difficulties, and the sounds produced by each speaker during the recording sessions were found by the experimenter to be free of articulatory abnormalities.

Five alternate printed word lists (Appendix B) were prepared containing the English sounds involved in the experiment. On each list was printed for each sound a simple English word containing that sound; immediately to the left of the word was printed the letter or letters representing the sound in question; the critical letter(s) were also underlined in the word itself. Although this system for denoting the sounds to be pronounced may be phonetically inelegant, some procedure of this general type was required since the American speakers could not have been expected to read the usual phonetic notation for each sound.

In each of the five lists, a different random order of sounds was used, except that within each list all 15 vowels appeared first, followed by the 23 consonants. For the consonants, the same example words were used across the five lists; for the vowels, different example words were used for each list to minimize the possibility of an atypical pronunciation on the basis of a particular word. All of the vowel example words were also checked in Kenyon and Knott Pronouncing Dictionary of American English (1944) to corroborate the intended pronunciation.

Each speaker was recorded individually in a professional double-walled studio about 5' x 8' in dimension. Adjustable drapes were arranged to provide a highly non-reverberant environment. The speaker stood facing a microphone (Sennheiser MD421) at about 15 inches distance, with one of the five word lists attached to the side of the microphone at eye level.[1]

Verbal instructions given each speaker directed him to say aloud each English sound in the list as it would be pronounced in the example word, but not to say the word itself. Vowels would be pronounced alone; consonants were to be pronounced with the helping vowel /a /.[2]

Timing for the recording was provided by a small white light which was automatically controlled to blink for about 1/2 second at 10 second intervals. After each blink, the speaker pronounced the following sound on the list. Using a specially adapted tape recording deck

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[1]The lists were changed for each of the first five speakers, and repeated in the same order for speakers six through ten.

[2]Thought had originally been given to the use of /ə / as the helping vowel, and hence the example words for the consonants show /ə / following the consonant in question. This is not felt to have affected the speakers' use of /a / as a helping vowel, since in most cases the speaker needed to look only at the left-hand column (showing isolated consonants) in order to make his response. For the few cases in which it was necessary to look at the example word to determine the pronunciation of the consonant (as with c : come), the speakers did not appear to have any difficulty in adding the helping vowel /a /.

("Laconic I"), each sound was recorded separately on a flexible card approximately 3 1/4 x 7 1/2 inches in size which had a strip of magnetic recording tape glued on near the bottom edge. As the card ran past the recording head of the tape deck, approximately 2 seconds were available for recording; by feeding cards into the mechanism at appropriate intervals, each sound could thus be recorded on a separate card. A detailed description of the recording cards and of the Laconic I tape deck is given in Appendix C.

During the recording sessions, the experimenter monitored the recording volume by means of a VU meter so that the recorded volume was essentially similar across speakers. Volume levels among sounds varied to some extent (as would be the case in normal speech), but in no instances were the recorded sounds either too low in volume or disturbingly loud.

For the most part, the subjects were easily able to read aloud the 38 sounds from the list. Occasionally, it was necessary to re-record a card due to the accidental skipping or obvious mispronunciation of a sound. In no case, however, were the speakers asked to "improve" intelligibly rendered sounds or otherwise coached in their production of the sounds.

After all the American speakers had been recorded, the 380 sounds obtained (38 phonemes by each of 10 speakers) were randomized using a large table of random numbers and a selection-without-replacement procedure. Since each sound was recorded on a separate card, this randomization could be quickly and easily accomplished. The sounds

were then re-recorded onto continuous tape by playing back the cards through the Laconic I deck into a Tandberg 74 recorder operated at 7 1/2 inches per second. The sounds were separated by a 10-second pause, and each sound was preceded by a low-volume "beep" tone of about 400 cps and 1/2 second duration. The overall cycle for the English sound tape was thus as follows: tone, 1-second pause, stimulus sound, 10-second pause, next tone.

Ideally, the French judges used for this experiment should have been selected from among members of the basic criterion group of indigenous native speakers of French. However, since scheduling and other considerations made it impossible to use indigenous speakers for this part of the study,[1] an effort was made as an alternative to find in the Cambridge, Massachusetts area speakers who had only recently left France or whose total exposure to English, particularly in spoken form, had been very slight.

A total of ten judges was used; these judges, all native speakers of French, were adults ranging in age from 19 to 29. All participants in this judging group were women. The French judge with the longest experience with English had been in the United States for 4 years. A second and third judge had been in the United States for 7 and 8 months, respectively, and the remaining 7 had been in the U.S. for periods ranging from 4 to 16 weeks, with a mean residence of 10 weeks.

To their knowledge, none of the judges had hearing or speaking

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[1](It was, however, possible to use indigenous native speakers as judges in Experiments II and III.)

problems, and work with the judges in the course of the experiment did not suggest any difficulties of either type.

Since listening facilities permitted the participation of a maximum of 6 judges at a time, judging of the English sounds was carried out in separate but similarly conducted sessions. For each session, the judges sat around a large table in a quiet conference room and listened to the sounds through individual, padded earphones (Lafayette F767). For the sake of privacy and to provide uniform judging conditions, three-sided masonite enclosures similar in size to a language laboratory booth were placed on the table at each judge's position.

Judging instructions (Appendix D) were tape recorded, in French, by a native woman speaker and were played at the beginning of the judging session. On this tape, the judges were told that they would hear a number of sounds and that their task would be to determine, for each sound, whether a similar sound existed in French in the sense that they could think of a French word containing that sound. If they felt that a corresponding French sound existed, they would write a short French word containing that sound on an answer sheet provided (Appendix E). If they felt that no similar sound existed in French and were unable to think of any French words containing that sound, the judges would write PE ("pas d'équivalent") instead of an example word. The judges were asked to ignore details of pronunciation accuracy and not to consider whether the sound in question had actually been produced by a native French speaker, but simply whether an analogous sound

(and hence, words embodying that sound) existed in French.

Beyond the basic judging rules described above, certain practical details were also discussed in the instructions. The judges were told that they were free to write any word that came to mind in response to the stimulus sound. If they wished to do so, they could repeat words previously used, and the words could be as short and as simple as desired. So long as the responses were legible, there was no requirement to print the answers. If any judge felt that a certain sound existed in French but could not for the moment think of an example word, he would simply raise his hand for additional time. During the judging sessions, extra time was only rarely needed, and usually near the beginning of the session; for the most part, the stimulus-response timing seemed quite appropriate--on the one hand allowing sufficient time for each judge to write his responses, and on the other, moving at a sufficiently rapid pace to eliminate unnecessarily long waits after each sound. Informal conversation with the judges following the sessions indicated that they had been able to respond freely in the judging situation and had not felt hurried or otherwise hindered in making their judgments. Judging of the entire set of 380 sounds required about 1 1/2 hours of working time; two short rest periods were allowed, during which the judges were asked not to discuss the experiment among themselves.

At the completion of the judging session, each judge was asked to enter the recording studio and to read aloud for recording each of the words which he had written. The purpose of this recording was to

permit an auditory check of the sounds represented.

Verification of the sounds intended by the written responses was carried out by the experimenter in the following manner: templates giving a phonetic transcription of the English sounds presented on the stimulus tape were held beside the judges' response sheets; at the same time, the tape containing the judges' pronunciation of the sounds they had written was played back. For each sound, the experimenter wrote down the French phoneme involved. In most cases, the scoring was completely unambiguous; for example, sous, fou, comme, été, and eau could immediately be scored as /s_f /, /f_f /, /k_f /, /e_f /, and /o_f /, respectively. Even such sounds as /$ø_f$ / (meuse) and /$œ_f$ / (leur) were easily heard and scored, since the sound quality of the recordings was quite high and the experimenter had considerable experience in French phonetic transcription.

Occasionally, however, a written word was ambiguous in the sense that it allowed more than one possible interpretation of the sound intended; one example is the word auto (which the French judge pronounced /ɔto /) written in response to the spoken English /o /. From this word alone it was not possible to determine which of the two vowels had been intended; in these and similar cases, the response was marked as "ambiguous." The total number of ambiguous entries was quite low, and for individual sounds (see Tables 2 and 3) the ambiguous entries are generally so few that they may be discounted almost completely in interpreting the results.

Although the scoring system was intuitively considered highly

Table 2

Experiment I

French Phoneme Responses to English Vowels

(Basic Data)

English Vowels	No Equivalent (%)	French Vowels[a] i	e	ɛ	a[b]	ɑ[b]	ɔ	o	u	y	ø	œ	ə	ɛ̃	ɑ̃	ɔ̃	œ̃	aj	ɥu	au	oj	ej	ao	ij	je	Ambiguous (Unscorable)
aj	17					1												80	1							1
ɛ	13		6	66							4	5	3													3
U	15				1		7	2	5		32	18	17													3
I	26	13	20	17							2	1										1		3	4	13
a	5				63	32																				
u	18							2	78		1															1
i	3	88																						9		
æ	23		4	23	31	8					2	2	1	3	1											2
ə	14				31	11	1				16	12	8	1	1					1						4
e	34		39	16		1																5				5
au	78			1	2			1							1			3		2			12			
aj	80						2											8			9					1
o	44						11	40	2														1			2
ɜ	22				27	17	17	11							2	1										3
ɥu	37								2										60							1

Note.--Cell entries are actual response frequencies. (Row) total for each English vowel = 100.

[a]Entries to right of dashed line show "non-permissible" French diphthong responses.

[b]Scoring distinction between /a / and /ɑ / not considered reliable.

Table 3

Experiment I

French Phoneme Responses to English Consonants

(Basic Data)

English Consonants	No Equivalent (%)	French Consonants[a] j	ɥ	w	p	t	k	b	d	g	f	v	s	z	ʃ	ʒ	l	ʁ	m	n	ɲ	tʃ	dʒ	Ambiguous (Unscorable)
k	5						95																	
f	20										79													1
s	2												96		1									1
ʃ	6														1	90						3		
t	45				1	1	2		6		2	32	1	6			2					2		
tʃ	52						1								8	[illegible]						3	30	
v	15			1							2	82												
j	25	75																						
h[b]	42																							[illegible]
p	7				80	1		1												1				4
w	10			81				1				1					[illegible]							
m	1																3		95	1				
l	4			4													91							1
b	10				24			59			1								2					4
d	4				1	21		1	72															1
g	3						59			38														
θ	49					2		1			38		8											2
r	71			10							1	1					1	15						1
n	3																11		2	84				
tʃ	66														5							28	1	
ʃ	1														99									
t	15					84																		1
z	14												9	77										

Note.--Cell entries are actual response frequencies. (Row) total for each English consonant = 100.

[a]Entries to right of dashed line show "non-permissible" French consonant clusters.

[b]Responses to /h(a)$_e$ / were in addition to those shown: /e$_f$ /, 1; /a$_f$ /, 31; /ɑ$_f$ /, 12; /ɔ$_f$ /, 1; /ø$_f$ /, 1; "/h$_f$ /", 10.

reliable, a second scoring of all the sounds was made by the experimenter approximately ten months after the first scoring. In the rescoring, the original indications were hidden, and the sounds were scored using the same methods as previously.

Of the 3,800 responses involved (38 phonemes x 10 speakers x 10 judges), there was found a total of only 95 scoring differences for the two occasions. Examination indicated that 23 of these differences were due to mechanical errors (patent miskeying), and 45 involved difficulties in distinguishing the French /a / and /ɑ / (to be discussed). The remaining 27 discrepancies involved for the most part sounds which had been marked "ambiguous" on either the first or second scoring; in listing the scoring results (Tables 2 and 3), any sound scored as ambiguous on either or both occasions is so entered in the tables.

Although the basic data presented in Tables 2 and 3 are legitimate representations of the experimental results, certain considerations make it useful and appropriate to make slight modifications in establishing the "final" data tables (Tables 4 and 5).[1] First, as previously mentioned, it had proved quite difficult to make a reliable distinction between /a_f / and /$ɑ_f$ / as given by the French speakers on many occasions. Although traditionally-based manuals of French orthophony (see particularly Fouché, 1956) maintain the existence of two separate sounds whose pronunciation is governed by rather strict orthophonic rules, the A sounds pronounced by the French judges in response to the words they had written did not in many cases bear out this distinction, since the

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[1]The reader may wish to note the location of Tables 4 and 5 (pp. 38-39), since these tables will be referred to frequently in subsequent pages.

Table 4

Experiment I

French Phoneme Responses to English Vowels

(Final Data)

English Vowels	No Equivalent (%)[b]	Ambiguity Index[c]	French Vowels: i	e	ɛ	a[d]	ɔ	o	u	y	ø	œ	ə	ɛ̃	ɑ̃	ɔ̃	œ̃
a*[a]	5	--				95											
i*	12	--	88														
ɛ*	13	1.18		6	68						4	5	3				
ʊ	15	2.22				1	7	2	5		33	19	18				
ə	16	1.90				44	1				17	13	8	1	1		
u*	18	.24						2	79		1						
æ	23	1.85		4	23	40					2	2	1	3	1		
ɔ	23	1.56				45	18	11							2	1	
ɪ	39	1.86	15	23	20						2	1					
e*	41	.99		41	17	1											
o*	46	.97					11	41	2								
au	95	1.92			1	2		1							1		
ɔi	98	--					2										
ju	98	--							2								
ai	99	--				1											

Note.--Cell entries are response percentages which take into account "no equivalent" entries but exclude the "ambiguous" responses shown in Table 2.

[a]Starred vowels are those included in Experiment II.

[b]Includes French diphthong responses shown in Table 2.

[c]Based on recomputed response percentages (not shown) which exclude "no equivalent" as well as "ambiguous" responses.

[d]Includes various timbres (see text).

Table 5

Experiment I

French Phoneme Responses to English Consonants

(Final Data)

English Consonants	No Equivalent (%)[b]	Ambiguity Index[c]	French Consonants: i	ɥ	w	p	t	k	b	d	g	f	v	s	z	ʃ	ʒ	l	R	m	n	ɲ
m*[a]	1	.27																3		95	1	
ʃ*	1	--														99						
s*	2	.08												97		1						
g*	3	.96						59			38											
n*	3	.64																11		2	84	
l*	4	.24			4													92				
d*	4	.91				1	21		1	13												
k*	5	--						95													1	
p*	7	.24				90	1		1							1	90					
ʒ*	9	.08											1					7				
w*	10	.56			81				1											2		
b*	10	1.06				25			61			1										
z*	14	.47												9	77							
v*	15	.23			1							2	82									
t*	16	--					84															
f*	20	--										80										
j*	25	--	75																			
ʤ	46	2.04				1	1	2		6		2	33	1	6			2				
θ	50	1.00					2		1			39		8								
r	72	1.57			10							1	1					1	15			
ʤ	85	1.28						1								8	6					
ʧ	95	--														5						

Note.--Cell entries are response percentages which take into account "no equivalent" entries but exclude the "ambiguous" responses shown in Table 3.

[a]Starred consonants are those included in Experiment II.

[b]Includes consonant cluster responses shown in Table 3.

[c]Based on recomputed response percentages (not shown) which exclude "no equivalent" as well as "ambiguous" responses.

tendency of most speakers was to pronounce such words as la (theoretically, /la /) and pas (theoretically, /pɑ /) with an A of essentially equivalent timbre, usually close to /a /. In some cases, however, a differentiation was made, but inconsistently or "incorrectly."

The ambivalence of the /a / - /ɑ / distinction in present-day French has been pointed out by several authors. Pierre and Monique Léon (1964) state that "la distinction entre les deux A tend à disparaître au profit du seul /a / antérieur" (p. 13); Straka (1952) suggests that a difference in timbre is currently made only in rather careful ("soignée") speech while everyday usage favors a more anterior /a / under all conditions. In any event, for the 10 French judges who participated in this experiment, the timbre of the A was found, though favoring an anterior /a /, to be somewhat ambiguous and unstable, and for this reason all French A responses, regardless of exact timbre, have been categorized under a single /a / symbol in Table 4. It should be remembered, however, that some variation in timbre is included in this category.

A second problem involved words for which the English stimulus had been /h(a) /. Theoretically, initial h is not pronounced in French, except occasionally in loud, emphatic, or emotional speech. Thus, in listening to an English /h(a) /, the judges would, if they had "heard" the /h / state that there was no equivalent sound; if they did not perceive the /h /, they would presumably treat the English sound as though it had simply been an /a /, and would write such example words as ma, sa, arbre, and so forth.

The results, however, are not so clear-cut, since the French judges were found to respond in four different ways, specifically to: 1) write PE, 2) write a word containing an /a / sound but not a written h, 3) write a word containing a written h (hasard) but not pronounce the h when reading the word, 4) write a word containing a written h and also pronounce the /h /.

From these results, it is thus not possible to define with certainty the extent of acceptance of the aspirated /h /. It may be assumed that judges responding PE did in fact perceive the /h /, since they were able to reject it as "not a French sound." It could also be assumed that judges responding with words not containing a written h (ma, arbre) did not perceive the /h / but considered, rather, that only an /a / sound was in question (or, possibly, hearing the h did not consider it as a separate consonant but as some sort of "breathed" /a / which was phonemically acceptable to them).

However, the situation is not so clear for responses containing a written h, since from the written evidence alone, the judge could have intended simply an /a / and by chance have given an example word containing h, or, in view of the fact that several of the written h's were later actually pronounced by the judges, a pronounced /h / could also have been intended. Further, individual judges showed some inconsistency in this respect, on some occasions pronouncing the written /h / and on others leaving it silent.

For purposes of response scoring (as shown in Table 3), a French "h" was assigned in each instance in which the French judge wrote a

word containing h and also pronounced the /h /; responses involving words without a written h or words with a written h which was not pronounced by the judge were entered under the vowel involved (for the most part, /a_f /); any PE responses were, of course, entered under that category.

In view of the problems discussed, it was decided that a meaningful appraisal of the English-French "equivalence" of /h / as a valid phoneme in the two languages could not be made from the data of this experiment, and the entry for English /h / is thus omitted in Table 5.

A further modification of Tables 4 and 5 consisted of classifying as "not equivalent" all responses indicating a French diphthong or consonant cluster (as opposed to a single sound). In planning the experiment, it had been expected that English sounds such as /au /, /ai /, /dʒ/, and /tʃ/ would be considered almost invariably as not equivalent to any French sound, since the French phoneme set lacks both diphthongs and consonant clusters. However, under the free response conditions of the experiment, several of the judges did find--apparently in many cases only after considerable searching--French "equivalents" for most of these English sounds. Some examples of these responses are: (for /ai /) paille, ail, Aïe!; (for /au /) Raoul, août; (for /dʒ/) Abidjan, jump, djébel; (for /tʃ/) tchèque, pitchoune, atchoumm.

Although it would have been possible to rule out responses of this type by providing the judges with a list of "acceptable" responses, this procedure had been decided against for the reasons previously discussed. It is, however, quite reasonable to assume that the French

judges would have marked "no equivalent" for the English sounds in question if they had been prohibited from recording diphthongs or consonant clusters; the fact that the judges went to such lengths to find words exemplifying these sound combinations would suggest quite clearly that they were not confusing the English sounds with any single French phoneme, for which example words would be much more plentiful.

Finally, in preparing Tables 4 and 5, the few "ambiguous" responses for each English sound were considered simply (and necessarily) as missing data; thus in Tables 4 and 5, cell entries are given as percentage figures which exclude the few ambiguous responses.

Results and Discussion

In determining the extent to which each English sound in this experiment may be considered to have demonstrated phonemic "equivalence" to some French counterpart, it seems necessary to take two major factors into account. First, of course, is the frequency with which the English sound was found to evoke a "French" response (that is, the selection of some French phoneme) as opposed to an immediate rejection of the sound as "not French" ("pas d'équivalent" response). Thus, to merit serious consideration as a "counterpart" sound, the English sound under examination would have to show a rather high level of acceptance as "French" (low frequency of judgment as having "no equivalent").

In addition to having a satisfactorily high "acceptance" level, the sound should not have been variously interpreted as representing two or more French phonemes. The strongest and most ideal equivalence situation would thus be for the English sound to receive no "non-French"

rejections whatsoever, and further, for the sound to be invariably paired with a single French phoneme. With respect to the data shown in Tables 4 and 5, an English phoneme exemplifying this ideal equivalence would have a percentage entry of zero under the "no equivalent" column and a percentage entry of 100 under one of the French phoneme columns. From a communicative standpoint, such a result would suggest that an English speaker could use his native-language pronunciation of the sound with complete success at the French phonemic level--the sound would not only be heard as a "French" sound but would also be identified, with no ambiguity, as representing a single French sound.

The situation might be somewhat different for an English sound which was judged, for example, as "not equivalent" to any French sound on 30 percent of the occasions presented, but as representing a single French phoneme for the balance of responses. It would not seem appropriate to consider this sound as quite so closely counterpart, since it was not considered "French" on a certain number of occasions. On the other hand, when accepted as "French," the lack of ambiguity as to the phoneme represented would suggest that the English sound would serve with some adequacy in the real-life situation. The experimenter tends to suspect, for sounds with moderate rejection levels together with high unambiguity levels, that judges' "rejections" were in large part made on the basis of phonetic rather than phonemic considerations. This possibility will be discussed in detail in describing the results for individual phonemes.

A third combination of "acceptance" and "ambiguity" factors would

be the case in which the sound was not rejected as "not French" to any appreciable extent but was, on the other hand, considered to represent two or more French phonemes. The communicative gravity of this situation would be quite great, since the French listener would believe that he was hearing a certain French sound, but would risk receiving an erroneous message. If the probability of selection of two or more French phonemes were essentially equal--or worse, greater for some non-intended phoneme--the chances of such misinterpretation would be appreciable.

A fourth possibility would be the virtually complete rejection of the English sound as having no equivalent in French. The communicative problem here would simply be lack of comprehension, and would presumably give rise to a request by the listener for repetition or reformulation. Although the listener would risk receiving "no message" in such a situation, he would probably not be subject to receiving an erroneous message as in the preceding case.[1]

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[1] "Erroneous messages," "misinterpretations," and so forth as used in this context imply only the mishearing of a single phoneme, whose misinterpretation in a real-life speech situation would probably not be troublesome since the correct interpretation could usually be supplied by context. (For example, a Spanish speaker saying "I came to the United States on a sheep" would not leave the English-speaking listener in serious doubt as to the mode of transportation.) Nonetheless, the concepts of "misinterpretation," "receipt of message," and so forth would appear useful even at the single-sound level, when it is borne in mind that an accumulation of single-sound ambiguities would hinder comprehension.

Although it is possible to obtain a general appreciation of the spread of French identifications for a given English phoneme by considering the number and magnitude of the row entries in Tables 4 and 5, a useful statistic for summarizing this spread is available from communication theory as the measure of average information for a discrete probability distribution. This is expressed by

$$H_i = -\Sigma p_i \log_2 p_i$$

where p_i is the probability of identification associated with a particular response category.[1]

For each English phoneme, H_i has been computed using as p_i entries the observed proportions of selection of "corresponding" French phonemes (row entries), excluding "no equivalent" responses. The obtained values of this "ambiguity index" are shown in Tables 4 and 5 adjacent to the English phoneme entries.

The reasoning behind the exclusion of the "no equivalent" responses was the thought that a response of "no equivalent" for a given phoneme is an absolute judgment which is qualitatively different from the attempted assignment of a corresponding French phoneme. On this basis, it seemed preferable to compute an ambiguity measure only on those cases open to ambiguity, that is, only on those cases representing the selection of one or more French phonemes; the "ambiguity index" can thus be interpreted as a summary of the extent of response spread among phonemes, given an initial identification of

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[1]See Garner (1962, pp. 19-24) and Shannon and Weaver (1949, pp. 18-22).

the sound as being "French."[1]

In appraising the index value obtained for each English sound it is helpful to consider a possible range of zero (corresponding to the exclusive assignment of a single phoneme) to a maximum of 3.91 (which would reflect the equiprobable assignment of all 15 French vowel phonemes). Corresponding range for the 20 consonants would be zero to 4.32. Since equiprobable assignment of all possible vowels or consonants would of course not be anticipated, figures approaching these maximum values would be unlikely. Inspection of the data shows a maximum obtained value among the vowels of about 2.2 for the English /U /, and about 2.0 for the consonant /ð /.

In examining results for the different English vowels (Table 4), /a_e / and /i_e / are found to correspond quite closely to the ideal definition of "counterpart" sounds. English /a_e / was judged with only 5 percent frequency to be "not equivalent to a French phoneme, and the remaining 95 percent of the identifications were all assigned to the French /a /.[2] The ambiguity index for this sound is of course zero. A similar lack of ambiguity is found for /i_e /, where all of the identifications of this sound as a French phoneme (88 percent of total responses) were given as /i_f /. Of the 12 "no equivalent"

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[1]Although the exclusion of the "no equivalent" entries from the ambiguity index calculations was considered to be the preferable procedure, little empirical difference was found for a computation including the "no equivalent" entries.

[2]This symbol includes various timbres (see p. 40).

entries, 9 were so scored because the response words contained diphthongs (bille, vrille), that is, 9 of these entries involved a response containing /ij_f / or "i-plus diphthong," which may still be interpreted as involving "some sort of /i_f /." In either case, the high phonemic congruence of /i_e / and /i_f / is evident.

There is a somewhat greater spread of responses for /ε_e /, which is reflected in an ambiguity index value of 1.18. As would be anticipated, the most frequent assignment was /ε_f / (68 percent of total responses, or 79 percent of the "French" responses excluding "no equivalent"). The second most frequent assignment was /e_f / (6 and 7 percent, respectively); additional choices of lesser frequency were /$œ_f$/, /$ø_f$ /, and /$ə_f$ /. Although by comparison to the identification as /ε_f /, the proportion of "incorrect" responses is fairly low, the possibility of occasional misinterpretation is nonetheless suggested.

The English /U / was found to be one of the vowels least closely counterpart to a single vowel in the French phonemic inventory. Only a small proportion (15 percent) of the total presentations were judged as frankly "not equivalent," indicating that the judges were for the most part quite willing to consider /U_e / as a "French" sound. The assignment of "equivalent" sounds, however, is quite ambiguous, and the index value of 2.22 is the highest of any English vowel. Approximately one-third of the responses give /$ø_f$ / as the proper equivalent; about a fifth of the choices are each assigned to /$œ_f$/ and /$ə_f$ /, with some correspondences, in descending order, given as /$ɔ_f$/, /u_f /, /o_f /, and /a_f /. Since /$œ_f$/ and /$ø_f$ / are for the most part in

complementary distribution (appearing in closed and open syllables respectively), the French listener might be expected, in an actual speech situation, to supply the correct timbre for this sound on the basis of context, even in the presence of a somewhat ambiguous rendering by an English speaker. That is, an English /pU / could probably be interpreted as /pø$_f$ / (e.g., <u>peu</u>), while /pUr$_e$ / would be received as /pœR$_f$ / (e.g., <u>peur</u>). Nonetheless, in view of its additional identifications, in varying proportions, as /ə$_f$ /, /ɔ$_f$ /, /u$_f$ /, /o$_f$ /, and /a$_f$ /, the English /U / cannot be considered to have a reasonable single counterpart in French.

The experimenter had, on an intuitive basis, expected English /ə/ to show a close phonemic correspondence to /ə$_f$ /. Experimental results show, however, that the closest correspondence (about half of the total responses) was given as /a$_f$ /.[1] This is an interesting outcome in view of the known tendency for French /a / in unstressed positions to be rendered by English speakers as a mid-vowel /ə/, since it shows that English /ə/ was in itself accepted as /a$_f$ / with considerable frequency. An implication here would be that English /ə/ may not be quite so grave a distortion of French /a / as it has usually been suggested.

Regardless of this consideration, the overall phonemic utility of /ə$_e$ / in the French sound system would be considerably reduced by its observed confusion with /ø$_f$ / and /œ$_f$ / (17 and 13 percent assignment respectively), as well as the fact that the presumably intended sound,

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[1] representing varying timbres (see p. 40).

/∂_f /, was selected by the judges with considerably lower frequency than were /a_f /, /$\emptyset_f$ /, and /œ_f /. Many phoneticians have maintained (see, for example, Fouché, 1956, p. xvii; Pleasants, 1962, p. 118) that the French /∂ /, at least in stressed position (me, te, donne-le) should be considered a full-fledged vowel having precise articulatory characteristics, including considerable lip rounding and muscular tension, which contrast to the more relaxed, indeterminate English /∂ /. If it can be assumed that these articulatory differences give rise to acoustically perceptible differences, the observed lack of correspondence between /∂_e / and /∂_f / would thus be anticipated.

Although the English /u / was considered by the judges as not similar to any French sound with a frequency of about 20 percent, the remaining responses, with virtually no exceptions, were assigned to the French /u /, suggesting a highly unambiguous reception of the English sound. As mentioned previously, there is a possibility that the "no equivalent" scores for this and other sounds reflect phonetic considerations to some extent. Although experimental instructions warned the judges not to consider details of pronunciation and to think only if a similar sound (and hence, words embodying that sound) existed in French, it may have been difficult in some cases for unsophisticated listeners to distinguish a clearly faulty phonetic realization (for example, a highly diphthongized vowel) from a phonemically unacceptable sound. Under a forced-choice arrangement in which "no equivalent" responses would not be allowed and some phoneme selection would be required in each case, it would be anticipated that

such phonetically faulty though phonemically acceptable sounds would be unambiguously assigned to the "correct" French sounds, thus eliminating the phonetic problem associated with a "no equivalent" category. However, this procedure would itself have significant drawbacks: for example, in cases of patent non-equivalence, the judges would still be required to indicate some French phoneme as their response, even though they felt that there was no real relationship between the two sounds. In addition to complicating the administration and analysis procedure (statistical provision would have to be made for this "random" response, which would in turn require a greater number of judges and/or stimulus presentations), the necessity for the judges to identify a "corresponding" phoneme--even when it was their considered opinion that no such sound existed in their language--might be a source of frustration and, eventually, of perfunctory attention to other sounds as well. In setting up the experiment, it seemed preferable to trust the judges to operate insofar as possible on a phonemic basis, taking into account the fact that in some instances phonetic considerations might inflate the "no equivalent" classification to some extent. In a sense, the "no equivalent" figures for each sound may be considered overly sensitive in that they reflect both genuine (phonemic) non-equivalence and a certain proportion of phonetic non-equivalence. For sounds for which the "French" response is highly unambiguous, it may be expected that the "no equivalent" responses were largely dictated by phonetic considerations. On the other hand, when the "French" responses themselves are seen to be widely distributed,

a fairly high level of real phonemic non-equivalance would be anticipated.

To properly interpret the observed results, it is felt that the "no equivalent" response figures should be mentally revised downward; this is particularly applicable when the "French" responses are highly restricted to a single phoneme. In the present case of /u /, for example, it is suggested that the 18 percent "no equivalence" figure may be almost completely discounted as involving phonetic rather than phonemic considerations.

The proportion of "no equivalent" responses for the English /ae / is only slightly higher than for /u_e /, but there is a definite spread of responses among the French phoneme choices. The most popular selection is /a_f / (40 percent), but an appreciable proportion (23 percent) of the total responses were allocated to /ε_f /, and there was in addition some selection (4 to 1 percent) of /e_f /, /$\emptyset_f$ /, /$œ_f$ /, and /$ə_f$ /, as well as the nasals /$\tilde{\varepsilon}_f$ / and /$\tilde{a}_f$ /. These results seem to suggest that in terms of aural reception by native French listeners, /$æ_f$/ tends to be ambiguously heard as /a_f / or /ε_f /; in the absence of contextual clues, a definite ambiguity between these two vowels (and others to a lesser extent) would be produced by the use of /$æ_e$/ in a "French" speech situation.

English open /ɔ/ is also found to be highly ambiguous to the French judges. The presumably counterpart French /ɔ / was selected in only 18 percent of the cases, while almost half of the total responses (45 percent) were assigned to /a_f /. From a communicative standpoint,

these results would appear to imply that use of /ɔ$_e$ / as a counterpart for /ɔ$_f$ / would be expected to produce misinterpretation even more frequently than it would a correct identification!

A possible extraneous factor in this "reversed" response situation may involve the fact that French open /ɔ/ does not normally appear in isolation,[1] as was the case with the English counterpart in the experimental situation. This may have had some effect on the judges' response: although the judges may have been listening to a sound which in its objective characteristics was quite close to /ɔ$_f$ / (and would have been so identified by a trained phonetician), their selection of /ɔ$_f$ / may have been subconsciously ruled out because of the improbability of hearing /ɔ$_f$ / in isolation.

It is interesting to note that about 10 percent of the responses were assigned to the close /o$_f$ /, which again may have been attributable to the oddness of an isolated open /ɔ$_f$ /.

As shown in Table 4, there is an increase of 16 percentage points in the "no equivalent" response between /ɔ$_e$ / and /I$_e$ /; in the latter case, almost 40 percent of the total responses identify the sound as "not equivalent" to any French sound. Further, for the remaining "French" identifications, there appears to be a fairly uniform (15-25 percent) distribution of responses among /i$_f$ /, /e$_f$ /, and /ɛ$_f$ /; the ambiguity index of 1.86 reflects this significant spread. Even though /I$_e$ / would probably not be deliberately used by American speakers as a French sound, the well-known tendency for the untrained American

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[1] Generally, /ɔ$_f$ / appears only in closed syllables.

speaker to lower the French /i / (or perhaps more accurately, his own /i_e /) when this sound appears in unstressed position (distinction, miniature) might be expected to lead to considerable misunderstanding on the part of French listeners. On the other hand, if this tendency were to be successfully corrected (that is, if the student could be taught to maintain /i_e / in all circumstances, rather than lower the sound to /I_e /, little communicative difficulty would be anticipated in view of the high level of correspondence found between /i_e / and /i_f /.

The English /e / was also found to produce a high proportion of "no equivalent" responses (about 40 percent), but on those occasions where it was assigned a French equivalent, the spread of responses was restricted to /e_f / and /ε_f /, with a ratio of selection of about 2 to 1 in favor of /e_f /.

The probable communicative gravity involved in pronouncing an English /e / which is received as /ε_f / rather than as /e_f / is an interesting question. Technically, a mishearing as /ε_f / of an intended /e_f / could lead to phonemic confusion in certain open-syllable word pairs such as <u>près</u>-<u>pré</u> (/prɛ / - /pre /), <u>lait</u>-<u>les</u> (/lɛ / - /le /), as well as certain verb endings (<u>chantais</u>-<u>chanté</u>, <u>irais</u>-<u>irai</u>). However, a recent tendency in colloquial French, particularly in the Paris region, has been to assimilate /ε_f / into /e_f /; even in cases involving potential confusion of meaning, these considerations have given way in large part to a uniform pronunciation as /e_f /.[1]

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[1] See, for example, the discussions by Le Bidois (1964, p. 6) and Politzer (1960, pp. 54-55).

In this light, it would probably be useful for the American student to acquire a pronunciation of /e_f / that would not be subject to confusion with /ε_f /, not so much in order to maintain an /e_f / - /ε_f / distinction in potentially ambiguous cases (a distinction which is often ignored by native speakers), but simply to make all of his open-syllable E's the close variety which appears currently in favor.

A somewhat similar situation is observed to exist for the English /o /: although the proportion of "no equivalent" responses is high (46 percent), the spread of identifications is for all practical purposes limited tc the two timbres of O, with about a 4 to 1 ratio in favor of the close timbre. Since the /o_f / - /$ɔ_f$ / distinction is usually allophonic (the two sounds with very limited exceptions appear in closed and open syllables respectively), a mishearing as open of an intended close /o_f / (i.e., /o_e / intended as /o_f / but heard as /$ɔ_f$ /) would not be anticipated to have serious consequences, at least on the phonemic level.

The remaining four English diphthongs, /au /, /ɔi /, /ju /, and /ai / were all found either to have been rejected out of hand by the French judges as "not equivalent" or, what amounts to the same thing in terms of the intentions of the study, were assigned example words exemplifying French diphthongs. The very small percentages of single-sound responses in these four cases may be considered essentially random identifications in light of the overwhelming proportion of "not equivalent" responses.

Finally, in reading Table 4 column by column, it is interesting to

note that of all the English vowels presented, none was heard as /y_f /, a finding which supports the usual pedagogical assumption that /y_f / is a totally new sound for American speakers. Similarly, the French nasals were for all practical purposes never paired with any English sounds: /$\tilde{œ}_f$ / was never elicited by any of the English vowels, and the other three nasals (/$\tilde{ɛ}_f$ /, /$\tilde{ɑ}_f$ /, and /$\tilde{ɔ}_f$ / were all reported with extremely low frequency and on an apparently random basis.

Turning to the consonant data (Table 5), it may be noted that on the whole the English consonants were more readily accepted as "French" than were the vowels. The mean "no equivalent" response for vowels is 42.7 (standard deviation of 11.0); for consonants, the equivalent figures are 27.6 and 9.0.

The ambiguity index for the French consonants is also generally lower than for the vowels, with mean values of .98 and .65, for vowels and consonants respectively.

A very high phonemic correspondence was found between four English consonants and their French counterparts: /$ʃ_e$ / (99 percent of total responses), /s_e / (97 percent), /m_e / (95 percent), and /k_e / (95 percent). On a somewhat less striking level, but with still quite high percentages of correspondence are: /l_e / (92 percent, with 4 percent /w_f / and 4 percent "no equivalent" responses); /p_e / (90 percent, with 7 percent "no equivalent" and 1 percent assignment each for /t_f /, /b_f / and /n_f /); /$ʒ_e$ / (90 percent, with 9 percent "no equivalent" and 1 percent selection of the unvoiced counterpart /$ʃ_f$ /); and /n_f / (84 percent, with 11 percent selection of /l_f /, 2 percent /m_f /, and

3 percent "no equivalent."

A pedagogical implication for all of the above sounds would seem to be simply to allow the use of the English sound as a phonemically acceptable version of the corresponding French sound, or at least, to set a quite low priority for the eventual "improvement" of these highly acceptable sounds.

A third group of sounds--/t_e /, /f_e /, and the semiconsonant /j_e /--exhibit a somewhat greater proportion of "no equivalent" responses (16, 20, and 25 percent, respectively), but show no ambiguity of selection among the French consonants.

A very interesting outcome can be observed for the English /b /, /d /, and /g /. For each of these sounds, the judges were found with considerable frequency to select the <u>unvoiced</u> French analog for that sound. Response figures for selection of voiced and unvoiced pairs are:

/b_f / 61 percent - /p_f / 25 percent

/d_f / 73 percent - /t_f / 21 percent

/g_f / 38 percent - /k_f / 59 percent

In the last instance, it is seen that the unvoiced counterpart was selected considerably more often than the correct sound itself; in all three cases, the possibilities of phonemic misinterpretation are obvious.

There is some research evidence (Cross and Lane, 1962; Liberman, Harris, Kinney, and Lane, 1961) that the perception of the voiced and voiceless consonant pairs /d / - /t / tends to operate in an "either-or" fashion, and that at some point in the gradual alteration of the acoustic parameters of the stimulus, an abrupt change in perception

takes place from one to the other consonant.

It is quite reasonable to assume that the precise acoustic parameters of the /d / - /t / perceptual categories (and those for other voiced-voiceless pairs) would differ for speakers of various languages; some suggestion of this is given in the Sapon-Carroll study (1958), in which "analysis along the dimension of voicing reveals a striking error in Japanese subjects' perceptions of /d / as its voiceless counterpart, in contrast to the absence of this type of error in Spanish and English-speaking subjects" (p. 67).

It is tempting to speculate that a similar effect was operating in the present experiment and that the English /b /, /d /, and /g / stimulus sounds, while clearly falling into the "voiced" category as far as American listeners would be concerned, were in many cases differentially received as belonging in the "voiceless" category for the native French listeners.

The phenomenon of voicing and the manner in which this acoustic feature varies across languages is a complex question which has only recently begun to receive close experimental attention;[1] however, it would probably not be necessary to wait for a detailed acoustic analysis of this feature in order to determine some simple articulatory instructions or pronunciation "tricks" which could be employed to improve the

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[1] Delattre (1965), on the basis of spectrographic analysis and pattern playback techniques, has found "at least seven" different acoustic correlates of "voicing" in English, and is currently conducting similar experiments for other languages.

pronunciation of the voiced English sounds for French phonemic purposes. Pleasants (1962) gives as a recommendation for the correct pronunciation of the French /b / that the student should have the larynx vibrate "as soon as lips close" (p. 35); for /d /, the larynx should vibrate "at the very beginning of the consonant" (p. 57). If some such instruction in earlier or more forceful voicing could shift the American speakers' pronunciation of these voiced consonants to a point at which they would be properly recognized by French listeners--that is, if the observed proportion of voiceless identifications could be added to the voiced category--then /b_e /, /d_e /, and /g_e / could be expected to serve with high success at the phonemic level. (Combined voiced-voiceless proportions are: /b_e / 86 percent, /d_e / 94 percent, /g_e / 97 percent.)

The English /r / was for the most part considered not equivalent to any French sound. Its rejection score of 72 percent is exceeded only by those of the consonant clusters /$dʒ_e$ / and /$tʃ_e$ /. It is, however, difficult to say whether this is really an effect of phonemic non-equivalence or whether the judges in fact recognized this sound as an "American r" (that is, as "some sort" of R) but out of some feeling of linguistic loyalty to the French tongue refused to consider it "acceptable," even phonemically, in French. Although the 10 French judges had for the most part been in the United States only a short time, a period of only a few weeks' stay would probably have been sufficient for them to be introduced to the stereotyped problem of "French /r /" vs. "American /r /" and to have had this point brought

to their close attention. To check the phonemic acceptability of /r_e / in French in the face of the widespread publicity (or notoriety) given this sound in teaching circles, tourist situations, and so forth, would probably require the use of indigenous French judges who had been insulated from the common phonetics lore involved.

The fact that /r_e / was heard as /w_f / with reasonable frequency (10 percent) would suggest that the French judges were occasionally misled by the English sound, but it remains difficult to establish the exact basis on which the judges assigned most of the /r_e / responses to the "not equivalent" category.

The four remaining English consonants (/ð /, /θ /, /dʒ /, and /tʃ /) can be considered on the basis of the observed results as quite clearly non-counterpart to any of the French consonants. For /$ð_e$ /, 46 percent of the responses were "no equivalent," and the remaining identifications were distributed over 9 different French consonants: /p /, /t /, /k /, /f /, /d /, /l /, /z /, /s /, and /v /. At 33 percent, /v_f / was the most frequently chosen "equivalent"; this selection seems reasonable in that /d_e / and /v_f / are both voiced slit fricatives, differing only slightly in their points of articulation (dentointerdental and labiodental, respectively).

An analogous interpretation is suggested in the case of English /θ / (unvoiced /d /), for which the closest French equivalent (39 percent) is seen to be /f_f / (or unvoiced /v /).

English /dʒ/ and /tʃ / were almost invariably rejected as not equivalent to any single French phoneme (85 and 95 percent rejection,

respectively), although in a few cases the sounds were heard as the voiced or unvoiced French counterparts for the second element of the combination. In terms of relative response frequencies, however, these responses are clearly outweighed by the high "no equivalent" scores.

Recent work by Delattre (1965) in the preparation of superimposed acoustic charts for the vowels of English and French[1] offers the possibility of comparing the observed French response patterns for English vowel stimuli to the relative positions of the French and English vowels on a common acoustic scale. The usual "acoustic chart" for a given set of vowels is obtained by plotting, on a logarithmic scale, points corresponding to the first and second formant frequencies of each vowel. The first formant is plotted along the ordinate, and the second formant along the abscissa. For both axes, the scales are reversed, that is, the frequency values increase toward the origin. A combined acoustic chart showing both French and English vowels on a single set of coordinates is presented in Figure 1.

Although the acoustic chart is roughly similar to the traditional vowel diagram, the former has certain advantages in that it reflects, through the formant positions, not only tongue height but also the degree of lip rounding and of tongue backing (movement of the mass of the tongue toward the back of the mouth, which is somewhat independent of tongue height). Thus, the point on an acoustic chart corresponding to a particular vowel is considered to represent a fairly accurate

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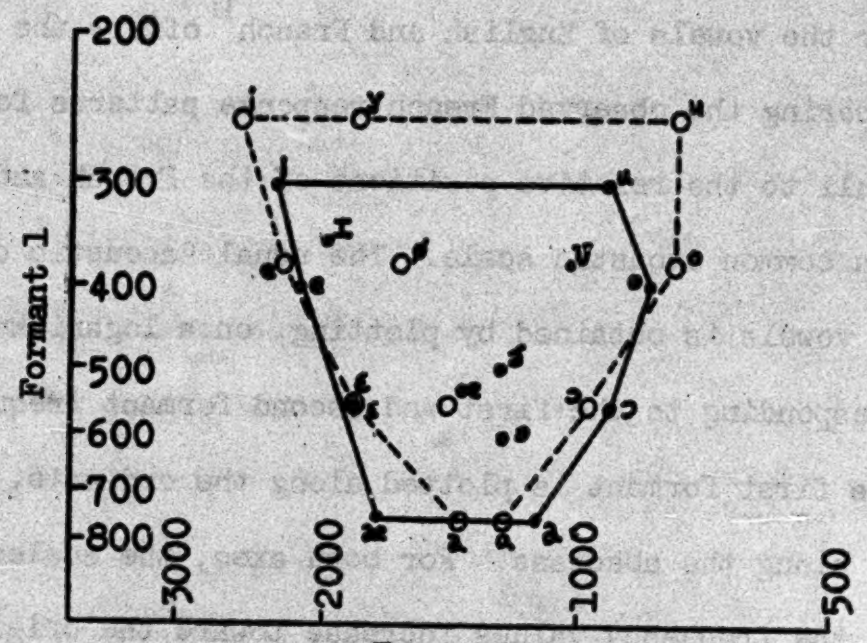
[1](German and Spanish charts are also presented)

Figure 1

Combined French-English Acoustic Chart for Vowels



• English

o French

[Adapted from Delattre (1962). French nasal vowels omitted for clarity.]

summary of the important articulatory as well as the acoustic characteristics of the sound.

It is reasonable to assume, on the basis of a combined French-English acoustic chart, that sounds in the two languages which are close to one another on the acoustic chart would also be perceptually close to human listeners. In an earlier study (Delattre, Liberman, Cooper, and Gerstman, 1952), phonetics students were asked to identify 16 cardinal vowels which had been produced synthetically by varying the frequency positions of first and second formants of hand-painted spectrograms; an interesting peripheral finding was that on many occasions when a presented vowel was incorrectly identified, the vowel erroneously selected was one of the vowels immediately adjacent to the correct stimulus on an acoustic chart. It could be anticipated that a similar effect would be observed in the present experiment, that is, that the French judges, hearing an English stimulus sound, would tend to label it as corresponding to the closest French sound on the acoustic chart.

By comparing the response percentage figures of Table 4 to the observed positions of French and English vowels in Figure 1, it is found that the predicted correspondence holds true for 8 of the 11 English sounds for which comparisons are possible;[1] also, in some cases,

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[1] English /au /, /ɔi /, /ju /, and /ai / were almost invariably rejected as "not equivalent" to any French sound, and further, do not appear on Delattre's chart because they would be represented by directed curved lines rather than points.

"second-choice" French vowels (those selected with the second highest frequency) are second closest to the English stimulus sound on the acoustic chart.

English /a / is closer on the acoustic chart to French /a / (and /ɑ/) than to any other of the French vowels. This is in keeping with the judging response data, which show a completely unambiguous selection of /a_f /[1] on every occasion when a "corresponding" phoneme was selected.

English /i /, for which /i_f / is the closest French vowel on the acoustic chart, was similarly unanimously identified as /i_f /. Since there were no "second-choice" responses in these two cases, it is not possible to carry the correspondences further.

The English /ɛ / was identified most frequently as /$ɛ_f$ / in keeping with the similar position of the two sounds on the acoustic chart. Some "second-choice" correspondence is also seen in that three of the French vowels "erroneously" selected[2]--/e_f /, /$œ_f$/, and /$ø_f$ /--are fairly close to /$ɛ_e$ / by comparison to the other vowels, although /a_f /, which is at approximately the same distance from /$ɛ_e$ / as is /e_f / received no selection by the judges.

The English /e / was identified most frequently as /e_f /, the closest French vowel on the acoustic chart. The second-choice /$ɛ_f$ / does not, however, correspond to chart distances, since /$ø_f$ / (which

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[1] This symbol includes varying timbres of A (see p. 40).

[2] /$ə_f$ / was also chosen, but does not appear on the chart given by Delattre.

was not selected on any occasion) is considerably closer to /e_e /; further, no second-choice responses were allocated to /i_f /, which is at approximately the same distance as /ε_f / from /e_f /.

A similar result is found for English /o /. The French /o / is closest to the English sound on the acoustic chart, and it also received the greatest proportion of identifications, in a ratio of about 4 to 1 over the second-choice /$ɔ_f$ /. However, the /u_f /, which is essentially equidistant as a second-choice possibility, received only 2 percent of the responses as compared to 11 for /$ɔ_f$ /.

Response figures for English /æ / also correspond to relative distances on the acoustic chart. French /a / received the greatest number of responses and is closest to /a_e / on the acoustic chart.[1] French /ε /, the next closest vowel, received the second highest number of responses.

English /u / is approximately equidistant from /u_f / and /o_f /, the two closest French vowels. By far the largest percentage of responses, however, was assigned to /u_f / (79 to 2 percent total identifications). Possibly, an upward shift in tongue position for the diphthongized /u_e / tended to produce an overall acoustic character closer to /u_f / than to /o_f / (formant positions on the acoustic chart are essentially steady state values). It may also be noted in this respect that there was no selection of /e_f / on the basis of a heard

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[1] A point midway between /a_f / and /$ɑ_f$ / has been adopted for measurement purposes, since response figures combine /a_f / and /$ɑ_f$ / responses.

/i_e /, even though /e_f / is reasonably close on the acoustic chart. Again, perceptual factors based on diphthongization (in this case, tongue raising and fronting) may be indicated.

English /U / is one of the three vowels for which the "first-choice" French responses do not correspond to acoustic chart positions. Although the closest French vowels on the acoustic chart are /o_f / and /$ɔ_f$ / (in that order), the majority of identifications by the French judges are assigned to the relatively distant /$ø_f$ / and /$œ_f$ /. A similar situation is observed for /$ə_e$ /. Although /$œ_f$ /, /$ɔ_f$ /, and (combined) /a_f / are approximately equidistant from /$ə_e$ / on the acoustic chart, a much higher percentage of identifications is allocated to /a_f / than to the other two vowels;[1] /$ø_f$ /, which is quite distant from /$ə_e$ /, also received an appreciable number of responses.

In the study by Delattre previously described (1952) it was found that "mid-vowels" (i.e., those vowels not located along the outside margin of the vowel "triangle") were on the whole less accurately identified than were the outside vowels. For the 16 synthetic vowels in Delattre's experiment, the 12 outside vowels had an average identification score of 62 percent; the corresponding figure is 34 percent for the four mid-vowels /ø /, /ɣ /, /œ /, and /ʌ /. Delattre suggests

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[1] Since the French mute E is not included in the acoustic chart, it is possible that /$ə_f$ /, if included, would fall much closer to /$ə_e$ / than do the other vowels. This would not, however, alter the situation, since experimental response figures would require that /a_f / be the French vowel closest to /$ə_e$ /.

that mid-vowels, being on the whole closer to one another than the outside vowels, are more subject to confusion. Since /U_e / and /$ə_e$ / occupy "mid-vowel" positions in terms of both the English and French acoustic charts, it is possible that a similar effect was operating in the present experiment.

The other "mid-vowel" in the English chart--/I_e /--was judged most frequently as /e_f /, which would be predicted from the vowel chart, but /$ø_f$ /, the next closest vowel, was bypassed amost completely as a "second-choice" selection in favor of the relatively distant /i_f / and /$ɛ_f$ /.

English /$ɔ_e$ / is one other vowel for which the judging results do not correspond to the situation suggested by the acoustic chart. Although /$ɔ_f$ / is by far the nearest French vowel on the chart, response figures show the appreciably more distant /a_f / to be a more popular identification by a ratio of approximately 2 to 1. It is possible that a factor peculiar to the experimental setup contributed to this result in that /$ɔ_f$ /, as has been discussed, usually appears in French only in closed syllables, rather than the single-sound context of the experiment. Thus, the pronunciation in isolation of this sound (or the English equivalent) might have been a quite unfamiliar stimulus for the French judges, who could be anticipated to "hear" instead the much more common /a_f / (which in comparison to the other French vowels is still fairly close to /$ɔ_e$ / on the acoustic chart).

To summarize the observed results, a definite relationship may be said to exist between the relative closeness, on an acoustic chart, of

French and English vowels and the extent to which they are considered "similar" by native French listeners. This relationship is most evident for "first-choice" responses; the selection of "second-choice" phonemes occasionally follows the same pattern, but to a much lesser extent. Two English mid-vowels, /ʊ/, /ə/, and the English /ɔ/ were not, however, found to correspond to these general results.

Chapter 2

Phonetic Acceptability of English Sounds in French

Preliminary Discussion

As discussed in the Introduction, the intent of this experiment was to determine the relative acceptability, at the French phonetic level, of each of the English speech sounds having a phonemic counterpart in French. In determining the English sounds to be included in the experiment, it was considered, first, that English sounds which were found in the preceding experiment not to have even a reasonable phonemic counterpart in French (that is, those sounds which the judges rejected as "not French" with a very high frequency or seriously confused with two or more separate French phonemes) would not merit testing at the phonetic level, with its more stringent criterion of experimental indistinguishability from native French sounds. On the other hand, it seemed inadvisable to set extremely high standards of phonemic equivalence in determining the sounds to be tested: only two English vowels (/a / and /i /) exhibited the ideal situation of very low rejection figures coupled with complete or virtually complete unambiguity of French phoneme selection, and although a greater number of consonants were found to meet this ideal situation, to restrict the selection of Experiment II sounds to this level would have excluded the investigation of a number of reasonable though admittedly less clear-cut equivalences. Since a primary purpose of the experiment was to

scale the relative phonetic acceptability of different English sounds in French in order to suggest instructional priorities, it seemed unsuitable to this general purpose to restrict the sounds tested to the few "elite" sounds that had reached the most demanding level of phonemic equivalence.

Thus, in selecting the English sounds to be included in Experiment II, a criterion of reasonable phonemic equivalence was adopted; generally, this involved a fairly low level of rejection as "not equivalent," together with phoneme response proportions indicating that a single French phoneme was selected with appreciably greater frequency than were any other choices. Although intuitive comparisons of the French and English phoneme sets doubtlessly entered into this selection (and in the case of /b_e /, /d_e /, and /g_e /, this consideration deliberately outweighed the response figures), it is felt that the experimental data obtained support in large part the choices made.

In the listing which follows, a summary statement of Experiment I results will be given for each of the English sounds tested, together with an indication of whether this sound was selected or not selected for inclusion in Experiment II.

Vowels

/a_e / - Highly acceptable as "/a_f /" (where /a_f / is interpreted to represent timbres varying between /a_f / and /α_f /). Very low rejection as "not equivalent" and no ambiguity of phoneme selection. (Selected)

/i_e / - Slightly greater overall rejection than in the case of /a_e /, but completely unambiguous selection as /i_f /. (Selected)

/ε_e / - Most frequently interpreted as /ε_f /, with rather limited selection of /e_f / and the mid-vowels /$\emptyset_f$ /, /œ_f /, and /∂_f /. Included in Experiment II on the numerical strength of the /ε_f / correspondence relative to the other phoneme choices. (Selected)

/U_e / - Quite serious ambiguity among /$\emptyset_f$ /, /œ_f /, and /∂_f /, and occasional confusion with four other vowels. Although ambiguous in isolation, word or phrase context would make the /$\emptyset_f$ / - /œ_f / ambiguity less critical. Not included due to lack of clear-cut identification with a single phoneme. (Not selected)

/∂_e / - Serious ambiguity among /$\emptyset_f$ /, /œ_f /, and /∂_f /, together with surprisingly high identification as /a_f /. Assuming that /∂_f / is the intended counterpart (n.b., a highly acceptable /a_f / is already available as /a_e /), identification as /a_f / would be misleading. (Not selected)

/u_e / - Non-acceptance level approaching 20 percent, but no real ambiguity of phoneme selection. (Selected)

/ae_e / - Non-acceptance level of close to 25 percent; considerable ambiguity of selection between /ε_f / and /a_f / with occasional confusion

among six other phonemes. No salient single counterpart sound. (Not selected)

/$\mathrm{ɔ}_e$ / - Fairly high non-equivalence level, misleading identification with /a_f /, presumed counterpart selected infrequently. (Not selected)

/I_e / - Non-equivalence level approaching 40 percent. Virtually equal probability of selection of /e_f / and /ε_f /, together with appreciable selection of /i_f /. No salient single phoneme equivalence. (Not selected)

/e_e / - High rejection score (41 percent), but phoneme selection restricted almost completely to /e_f / and /ε_f /, with 2 to 1 ratio in favor of /e_f /. (Selected)

/o_e / - High rejection score (46 percent) but no appreciable spread of phoneme identifications, which are clearly concentrated on /o_f / and /$\mathrm{ɔ}_f$ /, with a 4 to 1 ratio in favor of /o_f /. (Selected)

/au /, /ɔi /, /ju /, /ai / - Extremely high rejection score as "not French." Insufficient phoneme identifications to suggest any equivalent sound. (Not selected)

Consonants

/m_e /, /$ʃ_e$ /, /s_e /, /n_e /, /l_e /, /k_e /, /p_e /, /$ʒ_e$ /, /w_e /, /z_e /, /v_e /, /t_e /, /f_e /, /j_e / - Very high level of identification as single phonemes. (Selected)

/b_e /, /d_e /, /g_e / - Frequently confused with unvoiced French analogs. Although this would properly be grounds for rejection, the

three sounds were included in Experiment II on the basis that they should intuitively have counterparts in /b_f /, /d_f /, and /g_f /. (Selected)

/$\eth_e$ /, /θ_e / - High rejection scores, with appreciable phoneme spread, particularly in the case of /$\eth_e$ /. (Not selected)

/r_e / - Rejected as "not equivalent" with frequency approaching 75 percent. Although some rejection may have been based on non-phonemic factors (see discussion, p. 59), significant confusion between /r_f / and /w_f / further weakens correspondence. (Not selected)

/$d\jmath_e$ /, /$t\int_e$ / - Very high rejection as "not equivalent," insufficient phoneme selection to warrant assignment of counterpart sound. (Not selected)

/h_e / - Responses of Experiment I judges to this sound are difficult to interpret (see discussion, pp. 40-42). Included in Experiment II to determine whether this aspiration would be phonetically discriminable from carrier vowel alone. (Selected)

Before describing in detail the procedures used in Experiment II, it would be useful to discuss the method followed in more general terms and to give the rationale underlying its use.

The first consideration in planning the experiment was to specify a method for judging the speech sounds which would allow a phonetic level comparison between the English sounds and their French counterparts; judgments made on the basis of such a comparison would have to correspond to commonsense ideas of "phonetic equivalence" and at the

same time provide valid and reliable experimental data. In specifying the judging procedure, an immediate decision was made that only native speakers of French would serve as judges; although non-native teachers of French, professional phoneticians, and others do involve themselves with the judging of sound quality and the naturalness or accuracy of certain productions, their implicit standard of reference is (or should be) the responses of native listeners to the sounds in question. In order to avoid the necessity to assume that any non-native listeners would in fact respond as accurate proxies for native listeners, it seemed preferable to go directly to the native French listeners for the judging of the sounds involved.

The manner of presentation of the English sounds to the French judges was an important consideration from the standpoint of reliability and validity of the judgments. Probably the simplest approach would have been to present randomly and in isolation the various English sounds to be judged; following each presentation, the judge would be asked to mark "French" for a sound which he considered phonetically equivalent to a sound in his own language, and "not French" for any sound which, for whatever reason, did not seem to sound perfectly French. A major drawback in the use of this procedure would seem to be the inevitable confusion of phonetic and phonemic standards in the course of judging: since some isolated English sounds represent French words (/o /, /e /, /si /, /li /, etc.), there would probably be a tendency to react more favorably to such "word" sounds than to "non-word" sounds, even though the latter may be phonetically quite similar to a French sound.

A second procedure, which would successfully eliminate phonetic-phonemic distractions, would be to present two sounds, one after another, one of which would be a real French sound and the other the English counterpart in question. The task of the judges would then be to pick the "not French" sound. A procedure of this type has been followed, although in a non-experimental situation, by Jeanne Varney Pleasants (1959), who presents in her Phonetic French Dictionary sounds spoken by a native speaker of French (herself) together with counterpart sounds spoken by a native speaker of English. A similar technique has also been employed in the teaching and testing tapes accompanying the Drillbook of French Pronunciation (Valdman, Salazar, and Charbonneaux, 1964), where two different voices are used to present the French and English counterpart sounds.

Although such a procedure may be useful for instructional purposes, the use of two separate voices would be troublesome in a testing or experimental situation, in which the listeners could be expected to distinguish very quickly the two voices used on the basis of their timbre, average pitch level, and other characteristics. Even voices matched as closely as possible on these variables could probably be distinguished after a certain length of time, at which point judgment as to the "French" or "not French" quality of the sounds would give way to the simple identification of the speakers involved.

One solution to this problem would be to have both "French" and "English" sounds rendered by a single speaker, presumably a bilingual speaker of both languages. This procedure was adopted by Politzer (1961)

in producing the stimulus materials for a French-English auditory discrimination study. In such a case, however, there is always the possibility that the speaker would not be perfectly "native" in one or another of the languages; even if sufficient proficiency in both languages could be granted, there would still be the possibility that the speaker, in the experimental situation, would tend to emphasize the sound contrasts involved beyond the degree to which they would appear normally in the two languages.

If the use of a single "French-English" speaker is not advisable, the factor of identification of individual voices--a definite problem in the two-speaker situation--could be reduced appreciably by the use of a large number of French and English speakers; for each language, individual voices would appear and reappear on a random basis in the course of the judging presentation. Preliminary experimentation in a somewhat analogous situation (Clark, 1965) found that the use of as few as 16 speakers (8 in each language) made identification of individual voices quite difficult.[1]

A second advantage which could be obtained by including a large number of French and English speakers would be to allow for slight normal variations in the pronunciation of the speech sounds. Experimental procedures involving the productions of several different speakers would allow a broader interpretation of results, since they would be based on the productions of a sample of different speakers

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[1]The present experiment made use of a considerably greater number of speakers for both languages.

rather than the idiolect of a single model speaker.

Although the technique of presenting paired English-French sounds as produced by a number of different speakers seemed to answer to most of the problems discussed, the chance success factor in such an "either-or" judging situation would be a drawback of considerable magnitude. From a single either-or response made by a judge in a French-English pair situation, it would not be possible to tell whether the judge had selected the "non-French" sound on an acoustic basis or whether he had made a random and successful guess between equally appealing alternatives. Since the probability of responding correctly to all or a certain proportion of the presentations through pure chance is reduced with increasing numbers of presentations, the usual procedure to correct for chance guessing in this situation would be to present the same sound pairs on a number of different occasions. In view, however, of the large number of different sounds to be tested (24 separate phonemes), it became apparent that it would not be possible to provide a sufficient number of repetitions to reduce the chance success factor to an acceptable level without exceeding the amount of time and effort which the judges could reasonably be asked to spend.

A decision was therefore made to retain the several-different-voices technique, but to present the French and English sounds in a triplet or "ABX" format which would reduce the chance success factor to manageable proportions. Under this procedure, the French judges would hear three sounds, one of which would be the English sound in question, and the other two, French counterpart sounds which would

serve as "decoys" for the English sound. Within the triplets, the position of the English sound would be varied randomly, and it would be the task of the French judges to determine, for each triplet presented, which of the three sounds was "not French." Even if all three sounds seemed acceptable, the judges would be required to make a response; in the later analysis, a uniform allowance would be made for chance success.

It should be pointed out that the criterion of "phonetic equivalence" as defined by the judging procedure adopted is an extremely stringent one: under quite favorable listening conditions, the judge is given two real French sounds to serve as acoustic referents or "anchors" along with the English sound under examination. Any slight discrepancy in the English sound by reference to the two French sounds would thus be sufficient to mark it as "not French." On the other hand, English sounds which the judges were not able to distinguish from the French decoy sounds (except on a random basis) could fairly be considered indistinguishable, to native ears, from the real French sounds involved.

Procedure

The American speakers used in this experiment to pronounce the model English sounds were male students attending a junior high school in eastern Massachusetts. Twenty-eight of the 30 speakers were 13 years old; the other two were 14. Unlike the speakers used in Experiment I, the speakers for this experiment had a rather restricted geographical background: 28 of the 30 participants had been born in Massachusetts,

one in New York, and one in the state of Washington. Foreign travel had also been extremely limited. Twenty had never been outside the United States, nine had visited Canada (typically for a short weekend trip to Niagara Falls), and one had spent a summer in Europe.

About half of the subjects (17) had at the time of the experiment been participating for about 1 1/2 years in a German FLES program. Seven reported FLES study of French for periods of one to four years; six stated that they had never studied a foreign language. As in Experiment I, it is felt that foreign language study did not have a bearing on the speakers' performance as model native speakers of English: foreign languages were not mentioned in the course of the experiment, and the true nature of the data collection was not revealed (the speakers were led to believe that the experimenter was simply interested in recording English sounds). None of the speakers actually used in the experiment reported speech or hearing difficulties, and the experimenter found no anomalies of this type in the course of the experiment.[1]

Five word lists (Appendix F), each containing simple English words exemplifying the sounds to be tested, were prepared for presentation to the American speakers: these lists were simply condensations of the English word lists for Experiment I (Appendix B), from which the "non-counterpart" sounds had been deleted.

All sound recording was carried out inside a specially constructed

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[1](Two speakers who lisped were allowed to continue the experiment but were later replaced by other speakers.)

semi-portable booth approximately 7 feet high, 3 1/2 feet deep, and 3 feet wide. The basic construction material was 1/2-inch plywood, with interior insulation provided by 2-inch panels of fiberglass covered with burlap. Except for a double-paned window of about 1 square foot surface area, all wall, door, and ceiling surfaces were covered by this insulation. A padding of two layers of 1-inch felt was used as a floor covering. The booth itself was placed in a quiet alcove, and the general effect of this arrangement was to reduce all but the loudest noises (e.g., the end-of-period class bell) to an essentially inaudible level. In addition to cutting out outside noises, use of this booth provided a standard and highly non-reverberant recording background.

Inside the booth, the recording microphone (Sennheiser MD421) was placed on a floor stand and adjusted so as to be about eight inches below the speaker's eye level. The word list to be read was attached to the side of the microphone so that it could be read easily from a standing position in front of the microphone. The speakers were instructed to stand about 12 inches from the front of the microphone and not to move about in the course of the recording.

Instructions were given verbally to the subjects by the experimenter. Each speaker was told that he would be asked to say a number of English sounds as they would be pronounced in certain words, but that he should not pronounce the words themselves. Attention was called to the list on the microphone, the underlining of the particular sounds to be spoken, and their second representation at the left of the printed words. Each subject was told that the 7th and following sounds consisted

of consonants which, of course, could not be pronounced alone, but would have to be accompanied by the helping vowel /i /.[1] The experimenter at this point pronounced a few of the vowels and consonant-helping vowel combinations, and then asked the speaker to practice a few of the sounds for himself. Any further questions by the subject were answered at this point, usually through a repetition or paraphrase of previous directions.

A visual signal that the next sound on the list should be pronounced was given by a small white light attached to the microphone and controlled by the experimenter through a foot pedal.

When all instructions had been given the booth door was closed; after a check through the window that the speaker was facing the microphone and at a proper distance from it, the recording began.

All recording for this experiment was done directly onto individual sound cards, using the Laconic I tape deck (Appendix C). The experimenter flashed the light and at the same time started a recording card through the machine. Although there was slight variation, the average cycle of light - recording - next light was about three seconds. This provided sufficient time for the experimenter to run the recording cards through the machine and also for the speaker, after each pronunciation, to read silently the next word on the list and prepare his response.

For the most part, the recording of all 24 English sounds proceeded without incident; occasionally, however, the speaker would make a

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[1]The selection of this helping vowel is discussed on p. 94.

mistake, at which point the recording card would be erased, using a bulk eraser placed a few feet away, and the sound would be re-recorded. Mistakes occasioned by misreading words, losing place on the list, or other such disturbances, were corrected through re-recording; however, no attempt was made to have the speaker "improve on" any sounds which he had rendered intelligibly.

As previously mentioned, the ABX scoring procedure which was to be used required the recording of a number of "decoy" French sounds to be presented along with the English sounds. Since a sufficient number of school-age native speakers of French could not be obtained in the Cambridge, Massachusetts area, arrangements were made to record in France the decoy voices for this and subsequent experiments.

Negotiations were undertaken with a French technical lycée near Paris, and agreement to the use of students at that school was obtained. Although initial correspondence had suggested that students in the 13-14 year age bracket would be available for the recording, it was found at the time of actual recording that relatively few students of this age could be made available and that it would be necessary to use somewhat older students. The 30 French speakers used ranged in age from 12 to 18; mean age was 15.5, with a standard deviation of 1.5. The mean age of the English speakers was 13.1, with virtually no deviation. As it became evident in the course of the recording, the voices of the French speakers were thus on the whole somewhat deeper than those of the American speakers, though there was some variation in the other direction. The possible experimental influence of this discrepancy in

voice quality will be discussed in a later section.

Recording of the French decoy speakers was carried out in a manner similar to that for the American speakers. Five French word lists (Appendix G) were prepared giving common French words embodying the 24 French sounds identified in Experiment I as phonemic counterparts to the English sounds under study.[1] Verbal instructions given to the French speakers were of the same general character as those given to the American speakers, except that the experimenter now implied that the pronunciation of French sounds was being investigated. Reference was not made to English or to the ultimate purpose of the experiment.[2]

The same recording booth, microphone, and tape recording deck which had been used with the English speakers were transported for use in making the French recordings. Mechanical and acoustic conditions were thus highly standardized for the two groups; later discussions with the French judges for this and the other experiments indicated that in no cases had the judges perceived any mechanical or other background noises which could aid them in the judging of the sounds.

The French recording session was not parallel to the American in one respect: although assistants at the lycée made every effort to

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[1]As mentioned previously, English /h(i) / was included for investigatory purposes on the basis of ambiguous Experiment I results; the French "counterpart" in this case was /i_f /.

[2]Some interested students were informed after the recording session of the actual nature of the experiment.

obtain a large number of French subjects, it did not prove possible to allocate more than about thirty students to the recording of decoy sounds for this experiment (since a number of speakers were also required for use in Experiment III). Thus, it was decided that 30 French students would each be asked to pronounce two sets of decoy sounds, that is, to repeat the list of sounds immediately after it had been initially recorded. All of the French speakers were quite willing to do this, and no deterioration in pronunciation quality or lack of attention was detected for the second rounds of recording.[1]

The doubled recording procedure for the French sounds did imply that when the ABX triplets and judging tapes were later arranged, a given French voice would appear twice as frequently as a given American voice; however, the experimenter was fairly confident on the basis of prior experience that the total number of speakers involved (60 different voices) would effectively rule out the possibility of identifying individual speakers. Post-judging statements made by the various groups of judges in this and later experiments indicated that identification of individual voices was not in fact an element in the various experiments.

At the completion of the French decoy recordings, a total of 2,160 recorded sounds were available, representing 30 different productions of 24 English sounds and 60 different productions of the

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[1] Fatigue or inattention would not have been expected, since both recordings required a total of only about 5 minutes.

24 corresponding French sounds. It may be appropriate at this point to emphasize the practical value of the system employed for recording the sounds on individual cards, as opposed to the usual technique of recording onto continuous tape. The tedium and technical difficulty involved in cutting, randomizing, and splicing such large numbers of sounds was eliminated by use of individual recording cards, so that it became possible to deal with larger numbers of sounds and greater numbers of speakers than would have been practicable using a continuous tape recording and splicing technique.

The French and English stimulus sounds were arranged for presentation in a judging tape as follows: using a large table of random numbers, random numbers were assigned to each of the 720 English sounds (24 phonemes by each of 30 speakers) on a selection-without-replacement basis. After the English sound cards had been rearranged into the random order indicated, each sound was assigned two French decoy sounds by drawing two cards from a thoroughly shuffled deck containing the appropriate French counterpart decoy phoneme. In a few cases where the same French speaker happened to appear twice in a given triplet, the deck of decoy sounds was shuffled and a different speaker drawn for one of the two decoys, so that for each sound triplet three different voices would be heard. Finally, the serial position of the English sound within each triplet was determined in accordance with the sequential appearance of the numbers 1, 2, and 3 in a large random numbers table.

The sound triplets, arranged as described above, were re-recorded

onto continuous tape by playing back the recording cards from the Laconic I tape deck into a Tandberg 74 recorder operated at 7 1/2 inches per second. As the sounds were recorded on the upper track of this two-channel recorder, a "beep" signal of about 500 cps and 1/2 second duration was introduced onto the lower track through an electric timing circuit set to cycle at an interval of 15 seconds. The experimenter adjusted the feeding of recording cards in time with the tone signal so that the overall cycle was approximately as follows: tone - 1 second - first sound - 1 second - second sound - 1 second - third sound - 8 seconds - next tone.

Eleven native speakers of French served as judges for this experiment.[1] Participants were for the most part teachers of history, mathematics, and other subjects (excluding English) at the lycée, or on the lycée staff in some other capacity (principally, as surveillants responsible for student attendance and conduct). One judge, who was also the only woman participant, was the wife of one of the surveillants.

A detailed questionnaire (Appendix H) was administered to each judge to determine his age, general background, and especially, his exposure to English, both in formal classroom work and in extracurricular situations. Only one of the 11 judges had not studied English in a lycée, a fact which had been anticipated in light of a general foreign language requirement which makes the study of English (or in

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[1] Twelve judges were originally asked to participate, but one was found to have hearing difficulties of which he had not been aware, and his judging responses were later discarded.

certain cases, some other language) virtually mandatory in the lycée system.

One point should be emphasized with regard to the judges' study of English: first, since many educated French natives will have had some classroom exposure to English, this fact should probably be taken into account in defining a "real-life" criterion group of native speakers. That is, if many of the native French speakers with which the American student would have contact are at least slightly acquainted with English, it would seem unreasonable and artificial to seek a group of experimental judges who were atypical in the sense that they had been sheltered from this rather standard exposure to English. The important consideration for this group of French judges is not that they had taken English courses in the lycée but that they had not had significant exposure to English on an extracurricular basis. To the questionnaire item "En France, avez-vous été exposé à de l'anglais parlé en dehors de classe?" 7 judges responded "non, ou presque pas," 4 marked the choice "oui, un peu (des films, des disques, des programmes à la radio)." Extracurricular reading experience was equally limited; 8 judges reported that they had read English outside of class "pas du tout," and 3 replied that they had read "très peu (total d'un ou deux livres, une revue de temps à autre)." None of the judges had been members of English speaking clubs or "English houses," and none reported study of English prior to the lycée.

The most significant indication, however, of the judges' limited exposure to English is given by the figures for travel to English

speaking countries. Of the 11 judges, only 3 had ever visited an English speaking country; for these three, the lengths of visit were 1, 3, and 4 weeks.[1]

It is thus felt that the French judges used for this experiment may be considered representative of the large group of native speakers who, although having been exposed to a certain amount of English in the classroom situation, have had little further contact with the language.

A description of the stimulus tape of English-French triplets (one English sound and two French "decoys") has already been given. In the judging sessions, the task of each French judge was to listen carefully to each triplet and indicate which of the three sounds was, in his opinion, "not French." In detail, the judging was carried out as follows:

For administrative convenience, the judges were divided into two groups of six members each;[2] each group met on separate evenings but used the same meeting room and listening equipment, and followed the same judging and marking procedure.

The judges met in a large room (the language laboratory of the lycée) and were seated comfortably around a tape recorder (Tandberg 74) into which were attached by means of a junction box six high quality

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[1]This figure should be compared to total weeks abroad for the French judges with considerable knowledge of English (see Experiment IV), which ranged from 20 to 1277 with an average of about 320 weeks or approximately 6 years.

[2]One group included the judge whose responses were later discarded.

padded earphones (Lafayette F767). Although the judges could see one another, the distance between judges was great enough to prevent "looking on," and in any event there was little reason to do so, since no comparative scoring or other competitive element was implied in the judging procedure.

Judges' responses were recorded by them directly onto specially printed IBM "Portapunch" cards (see Appendix I for facsimile). The cards are similar to regular tabulating cards except that the punch positions in the cards are pre-scored so that the card may be punched by hand, using a metal stylus to punch out the desired position. Metal styli, as well as special plastic and rubber boards into which the card is inserted to facilitate punching, were provided with the Portapunch cards. Each card had sufficient space for the indication of thirty "A," "B," "C" choices: for each stimulus triplet, the judge would punch one of these letters to indicate which of the three sequentially presented sounds he considered "not French." A simple correction routine (see text of instructions in Appendix J) was provided in the event that the judge accidentally mispunched his card or wished to change an answer; for the most part, the cards were punched without changes, although the judges did not hesitate to amend their choices from time to time.

Instructions to the judges (Appendix J) were given by means of a pre-recorded tape; the speaker was a native French woman. Instructions were given in considerable detail, both with respect to the mechanical aspects of response indication and the aural basis on which the

responses were to be made. For the latter, the judges were told that they would hear three sounds, followed by a pause. Of the three sounds, two would be spoken by persons whose native language was French, and one would be given by a person whose native language was not French. For each triplet, the judge was to select the one sound which was "not French" and punch the appropriate space on his Porta-punch card. In the event that the choice was difficult, or if the judge, even after careful listening, could not tell which of the three sounds was "not French," he was instructed nonetheless to indicate one of the three sounds. It was emphasized that each and every one of the triplets must be marked and that none could be left blank.

Following these instructions, three example triplets were pronounced: two vowel triplets (/o_f / - /o_e / - /o_f /; /y_f / - /y_f / - /ju_e /) and one consonant-plus-/i / triplet (/r_e / - /R_f / - /R_f /); in each case, the difference between the French and English sounds was stressed so that the proper response would be evident. At this point, any questions by the judges were answered; it was found generally that an accurate knowledge of the task had been obtained by listening to the taped instructions.

Judging of the entire series of 720 sound triplets required two evening meetings of about two hours each for each group. During the meetings, rest periods were provided at frequent intervals. Although the judging of the many sounds involved was a painstaking and extended job, all judges seemed to mark their choices diligently and attentively throughout the judging session; discussion with the judges at the

completion of the sessions indicated that they had been quite interested in their judging activities and in the project in general.

Following the judging, all Portapunch cards were examined for proper punching and for judges' corrections; for any answer which had been amended by the judge, the card in question was repunched to indicate the intended correct answer. All response cards were then processed using computer programs to calculate the necessary summary data for individual sounds and judges.

Results and Discussion

Table 6 shows, for each of the English vowels involved in the experiment, the total number of correct identifications across judges (that is, the total number of times the English sound had been selected as "not French" rather than one of the decoy French sounds) and the percentage of correct identifications for that sound.

An immediate observation is that none of the six vowels approached the criterion of phonetic indistinguishability from the French counterpart (that is, a random level of responding corresponding to a percentage correct of 33 1/3). English /a /, the least well discriminated vowel and hence the most "indistinguishable" from the French counterpart, was singled out as "not French" on almost two-thirds of the total presentations; English /o /, the vowel most often identified as "not French," was distinguished from the French counterpart decoys with almost 95 percent accuracy.

Phonetic non-acceptance of the English consonants (Table 7) is

Table 6

Experiment IIA

Phonetic Acceptability of English Vowels

Phonemically Acceptable in French

Vowel[a]	Total Correct Identifications Across Judges[b]	Percentage Correct[c]
/a /	209	63.3
/i /	271	82.1
/e /	290	87.9
/u /	290	87.9
/ɛ /	291	88.2
/o /	311	94.2
Mean:	277	83.9

[a]In order of increasing ease of discrimination as "not French."

[b]Maximum possible score = 330 (30 speakers x 11 judges).

[c]Chance success level corresponds to 33 1/3 percent.

Table 7

Experiment IIA

Phonetic Acceptability of English Consonants
Phonemically Acceptable in French

Consonant[a]	Total Correct Identifications Across Judges[b]	Percentage Correct[c]
/j /	253	76.7
/ʃ /	277	83.9
/z /	278	84.2
/w /	279	84.5
/k /	280	84.8
/g /	288	87.3
/b /	292	88.5
/ʒ /	292	88.5
/m /	294	89.1
/n /	295	89.4
/d /	295	89.4
/s /	295	89.4
/v /	299	90.6
/p /	299	90.6
/t /	303	91.8
/f /	308	93.3
/l /	309	93.6
/h[d]/	313	94.8
Mean:	292	88.4

[a]In order of increasing ease of discrimination as "not French."

[b]Maximum possible score = 330 (30 speakers x 11 judges).

[c]Chance success level corresponds to 33 1/3 percent.

[d]Not considered phonemically acceptable; included for experimental purposes.

even more striking: the least well discriminated sound, /j_e /, was singled out from the French decoys on more than three-quarters of the occasions presented, and the mean correct identification for all consonants is higher than for the vowels (88.4 percent and 83.9 percent, respectively).

An important factor in these high identification scores, at least for the consonants, is probably the French judges' perception of the carrier vowel /i_e /, which is felt to have contributed appreciably to their selection of the stimulus as "not French."

The experimenter had adopted /i_e / as the carrier vowel for this experiment on the basis of results in a somewhat similar experiment (Clark, 1965) in which English /i_e / had been the least well discriminated vowel in a response situation in which the judge heard a single French or English sound and was asked to identify it as "French" or "not French."[1] Although /i_e / was evidently often considered "French" when presented as a single isolated sound, the finer discriminations which were possible in the present experiment--in which the judges heard two real French sounds which could serve as acoustic "anchors" for close comparison to the English sound--were sufficient to raise the discrimination of /i_e / to the high level of 82.1 percent (Table 6). Given a highly successful discrimination of /i_e / <u>per se</u>, it would not be surprising that successful "identification" of the English consonants

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[1]In the 1965 experiment, identification score across judges was only 18.8 percent for /i_e /, as compared to 33.3 percent identification of /a_e /, the next most acceptable English vowel.

would also be high.

Additional support for the suggested biasing effect of the carrier vowel would come from the rather common opinion that several English consonants should be considered highly similar to their French counterparts. Politzer (1960), in his discussion of French pronunciation problems for speakers of English, describes French /f /, /v /, /m /, /j /, /b /, and /g / as "close enough to their English counterparts so that they do not merit special discussions" (p. 49). Brière (1963) eliminated several French consonants from a pronunciation learning experiment on the grounds that they were sufficiently parallel to the English counterparts to cause no difficulty in perception or production by the American speakers. Thus, the very high discrimination levels for such English consonants as /m / (89.1 percent), /n / (89.4 percent), or /f / (93.3 percent) would not have been anticipated in the absence of external factors.

A second factor which probably contributed to the observed high consonant identification scores (and in this case, also to vowel scores) was an appreciable age difference between the English and French speakers. As previously noted, the average age of the French speakers was more than two years higher than that of the English speakers; it was found that for the most part the voices of the English speakers were higher and more youthful than were those of the French decoy speakers.

In view of these complicating factors, it is felt that the data presented in Tables 6 and 7 should be considered only in terms of relative identification frequencies across phonemes, rather than as

absolute figures, whose magnitude would give rise to the presumably erroneous conclusion that all English sounds are highly unacceptable at the French phonetic level. (The overall high identification figures do, of course, also result in a restricted range which attenuates even these relative differences to some extent.)

Two procedural changes suggested by the above considerations were first, to change the carrier vowel for the English consonants to some other sound which would presumably be less distinctive, and second, to insure that the English and French speakers were more closely comparable in age.

In conducting a replication of this experiment,[1] scheduling and other considerations made it impossible to re-record the French decoy sounds. It was thus necessary to maintain the original decoy sounds, which in turn implied continued use of /i / as the carrier vowel. It was, however, possible to record a second group of English speakers; by choosing somewhat older speakers, it was felt that differences in vocal characteristics between the English and French speakers could be minimized. At the same time, it would be possible to instruct the new group of English speakers, prior to their pronunciation of the consonants, to produce an /i / which more closely approximated the French sound. Although this procedure would admittedly be less desirable and probably less effective than a change in the carrier vowel, it was anticipated that it could reduce to some extent the unrealistically

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[1]The original and replicated experiments will be referred to as Experiments IIA and IIB, respectively.

high discrimination level for the English consonants.

A second group of 30 English speakers was made available by a public high school in the Cambridge, Massachusetts area. Average age of this second group of participants was 15.5 (standard deviation 2.0), a figure much closer to that of the French decoy speakers than was the case with the original English group. All participants were native speakers of English, most had been raised in Massachusetts, and had had little foreign travel except for occasional visits to Canada. None reported speech or hearing difficulties.

Recording of the second group of speakers was carried out using the same equipment (recording booth, microphone, and recording deck) as for the original recording; the booth and other equipment was set up in a quiet room similar to that for the first recording.

Recording procedures and instructions to the speakers in the IIB experiment were essentially the same as those used in the IIA experiment, except that in the latter case the students were instructed to pronounce a short, tense, and non-diphthongized carrier vowel with each of the consonants. This instruction took the form of example sounds spoken by the experimenter which contrasted diphthongized and non-diphthongized pronunciations. Each speaker then practiced non-diphthongized pronunciations for a few moments, with additional help by the experimenter as necessary. Although it cannot be claimed that this procedure quickly produced a "real French /i /" on the part of the English speakers, the experimenter's opinion, based on monitoring at the time of recording and in later playback of the stimulus tape, was that considerable

improvement in the pronunciation of the /i / had taken place by comparison to the original recordings. About five or six of the new speakers persevered, however, in pronouncing a distinctly diphthongized /i /, both in practice and during the recording, so results of the pre-recording instruction were not completely successful in this respect.

At the completion of this second series of recordings, a new English-French stimulus tape was prepared as follows: all of the individual French and English sound cards from which the original stimulus tape had been recorded had been maintained in the order of recording; from this deck of cards were withdrawn all of the original English sound cards and newly recorded English cards were substituted on a speaker-for-speaker basis (that is, all sounds of original speaker "one" were replaced by those of the new speaker "one," and so forth). Thus, for the new stimulus tape the order of presentation of sound triplets and the position of the English sound within each triplet were identical in the original and replicated experiment.

Judging of the second stimulus tape was done by a new set of 12 native French judges obtained through the lycée previously mentioned. This group consisted of seven men and five women; age range was from 21 to 31, with a mean of 24.7 (S.D. 3.1). As was the case with the first group of judges, the new French judges had little contact with English outside of the regular classroom situation. Two judges reported on the background questionnaire (Appendix H) that they had spoken English outside of class "un peu," and the other 10 reported

that they had never done so or "presque pas." Eight had never read in English outside of class, and two had read a total of one or two books or "une revue de temps à autre." None had participated in English clubs or similar activities, nor had any studied English prior to the lycée.

Travel to English speaking countries was even more limited for the second group of judges than for the first; in the new group, only two judges had visited an English speaking country, and only for two weeks each.

On the basis of these responses, it was considered that this new group of judges, except for the usual school studies, had no significant contact with English.

Results of the judging of the new French-English stimulus tape (Experiment IIB) are given in Tables 8 and 9 for vowels and consonants respectively. The "total correct identifications" entries for the IIA and IIB judging sessions are not directly comparable since they are based on different numbers of judges (11 and 12 respectively) and have a correspondingly different maximum identification score (330 and 360). Thus, it is more appropriate to compare percentages of correct identifications in the two cases.

For the vowels of the IIB situation (Table 8), an initial observation is that average discrimination level for these sounds is lower than for the IIA judging by a factor of 8.3 percentage points. A similar effect is observed for the judging of consonants (Table 9). Average percentage correct for the IIA and IIB situations is 88.4 and

Table 8

Experiment IIB

Phonetic Acceptability of English Vowels

Phonemically Acceptable in French

Vowel[a]	Total Correct Identifications Across Judges[b]	Percentage Correct[c]
/a /	180	50.0
/i /	256	71.1
/ɛ /	272	75.6
/u /	294	81.7
/o /	302	83.9
/e /	325	90.3
Mean:	272	75.6

[a]In order of increasing ease of discrimination as "not French."

[b]Maximum possible score = 360 (30 speakers x 12 judges).

[c]Chance success level corresponds to 33 1/3 percent.

Table 9

Experiment IIB

Phonetic Acceptability of English Consonants
Phonemically Acceptable in French

Consonant[a]	Total Correct Identifications Across Judges[b]	Percentage Correct[c]
/w /	231	64.2
/j /	266	73.9
/ʃ /	266	73.9
/ʒ /	281	78.0
/n /	282	78.3
/f /	285	79.2
/g /	288	80.0
/v /	290	80.6
/k /	290	80.6
/b /	292	81.1
/z /	294	81.7
/h[d]/	295	81.9
/m /	300	83.3
/d /	306	85.0
/t /	308	85.6
/p /	312	86.7
/s /	316	87.8
/l /	319	88.6
Mean	290	80.8

[a] In order of increasing ease of discrimination as "not French."

[b] Maximum possible score = 360 (30 speakers x 12 judges).

[c] Chance success level corresponds to 33 1/3 percent.

[d] Not considered phonemically acceptable; included for experimental purposes.

80.6 respectively, a difference of 7.8 percent in favor of lower discrimination of the IIB sounds. It may also be noted that scoring of the IIB stimulus materials provided a somewhat greater range in discrimination percentages than in the IIA situation.

These results tend to support the assumption that external factors leading to high discrimination levels were operating in the IIA situation, presumably, the characteristically younger voices of the English speakers and, for the consonants, the additional discrimination assistance rendered by the carrier vowel.

It is of course possible that an absolute difference in scoring ability for the two groups of judges was responsible for the observed changes, either wholly or in addition to changes in the stimulus materials; unfortunately, no materials common to both groups and which could have been used to control for differences in absolute judging ability were incorporated into the judging tapes. However, on the basis of an associated later finding, specifically that of non-significant differences in sound-judging ability among three widely and intentionally different groups of judges (native French speakers without knowledge of English; native French speakers with appreciable knowledge of English; American-born teachers of French),[1] the experimenter is led to the opinion that changes in the stimulus materials rather than overall differences in judging ability between the two groups were primarily responsible for the observed differences.

Since the scoring results for the IIB judging may be considered

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[1] See Chapter 4.

more representative of the "true" conditions for the sounds tested, primary attention will be placed on the IIB data.

An examination of relative discrimination levels for the six English vowels (IIB data in Table 8, p. 100) shows that /a_e / is by a wide margin the least well discriminated English vowel at the phonetic level. Percentage correct identification figures show an interval of 21.1 percentage points between /a_e / and the closest other vowel, /i_e /. This interval is even larger than the total range between /i_e / and /e_e /, that is, between the remaining five vowels. An immediate practical conclusion would be that for any future experiments on consonant discrimination which make use of a carrier vowel, /a_e / would be the most suitable choice, since it could be expected to give substantially less discrimination aid to the French judges than any other English vowel.

There are no differences of comparable magnitude between the other vowels, although some "break" may be seen between all pairs other than perhaps /u_e / - /o_e /, which differ by only 2.2 percentage points.

To obtain statistically meaningful standards for evaluating these discrimination differences, a one-way analysis of variance was conducted using as groups the six vowel phonemes; within each group were available 12 observations corresponding to the identification scores (total correct identifications of the English sound) of each judge for that phoneme. These identification scores could range from zero to 30, the higher figure representing the total number of presentations of a

given phoneme. Table 10 shows the summary results for this analysis; a highly significant overall difference is found for the native French discrimination of these English vowels.

Application of the Newman-Keuls procedure for tests on ordered pairs of means[1] produced a pattern of significant differences as shown in Table 10. According to these results, English /a / is significantly[2] harder to discriminate as "not French" than are any of the other five counterpart English vowels. The /i_e / is more acceptable as "French" than are /u_e /, /o_e /, and /e_e /, but there is not significant difference between the acceptability levels of /i_e / and /ε_e /. English /ε_e / is significantly harder to discriminate from its French counterpart than is the English /e_e / (the most consistently identified English vowel), but the difference between it and /u_e / or /o_e / is not significant. The /u_e / and /o_e / do not differ significantly between themselves in discrimination difficulty; of these two, /u_e / is significantly more acceptable than /e_e /, but no reliable difference is found between /o_e / and /e_e /. These outcomes are summarized graphically in Table 8 by means of vertical lines appearing next to the vowel symbols. Sounds sharing a common line do not differ significantly among themselves, but they do differ significantly from sounds with which they do not share a line.

Although judging data for the IIA stimulus tape are considered less valid than are the IIB results, it is interesting to note that a

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[1] See Winer, 1962, pp. 80-85.

[2] ($p < .05$)

Table 10

Experiment IIB

Analysis of Variance of English Vowel Discrimination

by Indigenous French Judges

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Vowels	5	1075.96	215.19
Within	66	462.92	7.014
Total	71	1538.88	

For Vowels $F_{(5, 66)} = 30.68$ $p < .01$

Differences Among Vowel Pairs

(Newman-Keuls, .05 significance level)

	a	i	ɛ	u	o	e
a		*	*	*	*	*
i				*	*	*
ɛ						*
u						*
o						
e						

rather similar response pattern is shown in the IIA vowel figures (Table 6, p. 92). Here also, /a_e / is the least well discriminated English vowel, and there is a similar jump in identification score of approximately 20 percent between it and /i_e /, the next most acceptable English vowel. The IIB data show virtually no difference in identification percentage values among /e_e /, /o_e /, and /ε_e /, which may explain to some extent the difference in ranking observed for these sounds in the IIA and IIB cases.

From a pedagogical standpoint, vowel results for the IIB data would suggest that at the phonetic level, earliest attention should be given to the improvement of English /e /. The importance of an early correction of /e_e / is further emphasized by the status of /e_f / as the vowel phoneme having the greatest relative frequency of occurrence in spoken French (19.29 percent), according to a recent tabulation by Delattre (1965, p. 62).[1]

Discrimination data for English /o / and /u / also suggest early pedagogical attention to these sounds. Frequency of occurrence is somewhat lower, however, for these two sounds than for /e_f / (6.40

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[1] Percentages of occurrence for the six French vowels at issue are given by Delattre as:

/e / - 19.29%
/a / - 16.69%
/i / - 12.39%
/ɛ / - 6.69%
/u / - 6.40%
/o / - 2.60%

percent for /u / and 2.60 percent for /o /), implying that on a statistical basis at least, mispronunciation of these two vowels would not be so salient in ordinary speech as would the mispronunciation of /e_e /.

English /ɛ / appears at least moderately acceptable at the French phonetic level, as does /i_e /, suggesting that attention to these sounds could be postponed somewhat in favor of earlier attention to other less acceptable sounds. Of the two, the greater frequency of occurrence of /i_f / (12.39 percent vs. 6.69 percent for /$ɛ_f$ /) would suggest first attention to that sound.

English /a / is the vowel which most successfully serves as a "French" sound at the level of phonetic equivalence. At a discrimination level of 50 percent (chance success corresponds to 33 1/3 percent correct identification), /a_e / may be considered to approach rather closely the rigorous equivalence standard imposed by the judging procedure employed. In terms of pedagogical urgency, an /a_e / - /a_f / distinction should probably be taught only after attention has been paid to the other less acceptable vowels.

Response figures for the English consonants, even in the IIB situation (Table 9, p. 101), are much less satisfactory than those for the vowels, largely, it is felt, as a result of the discrimination of the consonants' carrier vowel, which not only increased the absolute discrimination values to a level which may intuitively be considered too high but also narrowed the observed differences among the consonants. This narrowing of range is reflected in the fewer significant

differences found through the Newman-Keuls procedure. Although there is an overall significant difference in discrimination difficulty for the English consonants tested (see Table 11 for analysis of variance results), there are few significant differences among individual consonants; these are shown in Table 11 and summarized by vertical lines beside the consonant symbols in Table 9.

The English semiconsonant /w / was significantly less frequently distinguished from its French counterpart decoys than were any other of the consonants or semiconsonants; most of the other sounds were not found to differ among themselves in discrimination difficulty. English /p /, /s /, and /l /, three consonants most easily distinguished as "not French," were significantly more readily discriminated than were /j_e / and /$\int_e$ / at the other end of the scale, but there is no significant difference between their discrimination levels and those of the great number of vowels lying between these two extremes. The same is true, in reverse order, for /j_e / and /$\int_e$ /.

In view of the relative lack of discriminative power of the consonant data, a detailed ranking of the phonemically acceptable English consonants with respect to their acceptability at the French phonetic level is not justified. Nonetheless, the few significant results at the ends of the scale, together with a "replication" afforded by the IIA judging results, may permit certain general observations.

One suggestion is that the English semiconsonants /w / and /j /, as well as the consonant /$\int$/, are generally more acceptable as "French"

Table 11

Experiment IIB

Analysis of Variance of English Consonant Discrimination

by Indigenous French Judges

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Consonants	17	627.74	36.93
Within	198	1364.92	6.89
Total	215	1992.66	

For Consonants $F_{(17, 198)} = 5.36$ $p < .01$

Differences Among Consonant Pairs

(Newman-Keuls, .05 significance level)

	w	j	ʃ	ʒ	n	f	g	v	k	b	z	h	m	d	t	p	s	l
w		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
j																*	*	*
ʃ																*	*	*

sounds than are the other consonants. This is most clearly seen by comparing IIA and IIB data, in which these three sounds occur within the first four entries for each list, though in somewhat different order.

At the other extreme, English /l / appears to be a very clear giveaway as "not French" on a phonetic level: it is the most frequently discriminated consonant in the IIB data and second most frequent in the IIA data. This is generally in keeping with the observations of phoneticians that English /l / differs considerably from French /l / in articulatory properties. Valdman et al. (1964) state that "in initial position French /l / is sharp and produced with more muscular tension than its English equivalent" (p. 62). Delattre (1965) has compared the tongue positions for English and French /l / by means of X-ray photographs, and finds that even in prevocalic position English /l / is "less fronted and more retroflexed" than in French (p. 89). Judging results for Experiment III (attempted imitation of model French sounds by American speakers) also point to /l_e / as a sound which is quite easily discriminated as "not French," even when practiced for a reasonable length of time.[1]

According to the IIB data, English /s / is also highly discriminable, although this is somewhat less evident in the IIA figures. Delattre (1965, p. 78) suggests as an articulatory correlate that American /s / has a more alveolar articulation, while French /s / is

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[1] In Experiment III, this sound ranks fourth among 19 consonants in ease of discrimination as "not French."

essentially dental. This difference in tongue position produces a lower frequency of friction noise for the English sound, a feature which Delattre has found (together with certain differences in formant transitions) to be quite distinctive to French listeners. This distinctiveness is also borne out by Experiment III data, in which /s / was found to be the most easily discriminated consonant, even following practice by the English speakers.

Beyond these tentative suggestions for sounds near the ends of the discrimination range, it is not possible or advisable to suggest differences in discrimination difficulty (and hence, relative acceptability) for English consonants in French. A replication of this experiment using /a_e / as the carrier vowel could be expected to produce a much greater range of consonant discrimination scores and a greater number of significant differences among these sounds.

Chapter 3

Self-Shaping of French Phonemes by American Students

Preliminary Discussion

A basic consideration in planning the pronunciation learning experiment described in this chapter was the desire to keep the teaching method as simple as possible, from both theoretical and practical standpoints. By setting any instructional procedure at the simplest level which could be anticipated to produce the desired results, one avoids the possibility of "overteaching"--the use of more time, effort, or technical facilities than would be required to attain the specified goal. In terms of the present experiment, the simplest procedure for teaching the phonetically accurate production of a given French sound seemed to be that of "self-shaping" through the untutored imitation of model sounds. French sounds which could be learned to a criterion of native acceptability through simple repetition would not require the use of any more complicated procedures; on the other hand, the use of more complex teaching methods (such as formal coaching in the sounds to be produced, with or without use of various audiovisual aids) would be justified for sounds which are not learned acceptably through a self-shaping procedure. The usefulness of various additional techniques could in turn be examined experimentally, using the self-shaping results as a baseline against which the success of the new procedures could be measured.

Technically speaking, the imitation procedure used in this experiment was somewhat more complex than student imitation of sounds as they would be modeled by the classroom teacher, in that "activated" earphones were used; the speaker thus heard his own pronunciations directly rather than through bone conduction and free air conduction. Since the probable application of the self-shaping procedure would involve use of a language laboratory rather than classroom practice, it was considered that stimuli delivered through earphones would be the only practical means of presentation. It was in addition desirable to have the speaker's responses heard through the earphones to avoid the muffling effect of the earphones themselves.

Although the instructional arrangement was "complicated" to this extent, it was nonetheless quite simple in relation to other methods commonly used to teach pronunciation in that it deliberately excluded all of the following procedures:

1) pronunciation assistance by a human teacher (as opposed to teacher-less self-shaping or other programmed techniques)
2) preliminary training (programmed or unprogrammed) in sound discrimination
3) use of complex instrumentation or of sound-presentation procedures going beyond the simple "tape loop" approach[1]

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[1]The term "tape loop" is used here to indicate repetition, at fixed intervals, of a sound to be imitated. This presentation would probably be more conveniently made by means of a continuous reel-to-reel tape (as in the present experiment), rather than by an actual loop of tape.

4) formal instruction (programmed or unprogrammed) in sound production, including such procedures as the teaching of pronunciation "tricks," use of physiological descriptions or diagrams, or any methods other than the simple imitation of model sounds.

As a background to the present experiment, it would be useful to discuss briefly each of the considerations above.

The necessity for the active participation of a human teacher in the course of student pronunciation learning has recently been the object of considerable interest, quite probably as a result of increasing interest in foreign language programming and the development of automated language teaching devices (Carroll, 1963a; Lane, 1964a). The strongest evidence that a human teacher would not be required to train accurate sound production would be provided by positive results in this connection through programmed means alone. On the other hand, unsuccessful results in the programmed teaching of pronunciation would not prove that the use of a human teacher was indispensable but would simply show that the particular type of programming involved had not succeeded in the pronunciation teaching task; an even moderately successful outcome in this respect would appear sufficient to keep the possibility of efficient programmed teaching of pronunciation an open and challenging question.

In this light, an examination of the outcomes of several recent undertakings in the teaching of pronunciation (along with other skills) through

programmed means may be of interest.

Marty (1962) developed and tested a self-instructional program in French and found that accurate pronunciation was one of the behaviors least well taught by these procedures; his conclusion was that "the student reaches the best pronunciation he is able to produce, and which our present methods can give him, only when working with a trained teacher helped, preferably, by a tape recorder" (p. 17).

Carroll (1963b) designed a multiple-skill "audiovisual instructional device (AVID) to implement a program of self-instruction in Mandarin Chinese. This program included, among a number of other techniques, the tape recorded presentation of Chinese sounds for imitation by the students; in some cases, articulatory descriptions were also provided through programmed means.

Results of the program were found to bear out the author's preliminary assumption that "most students would in time learn to recognize and imitate Chinese sounds with reasonable accuracy, merely through practice in discriminating them, and through the opportunity to compare oral productions with a model, and study of explanations in terms of articulatory phonetics" (p. 22). However, it was also observed that the differentiated production of the Chinese tones was somewhat less well acquired. On the basis of comments made by students in the program, Carroll states that they were frequently unsure whether their responses to the Chinese models were sufficiently accurate, and also notes that the students seemed to vary considerably in the accuracy of their self-evaluations.

Lane and Schneider (1963), in a rigorous but small-scale experiment in the self-shaping of a Thai toneme, reported generally unsatisfactory results in student imitation; this, however, was considered to be independent of an accurate discriminative ability, which the subjects seemed to possess.

Morton (1960) conducted a full-year college level introductory Spanish course characterized by the use of intensive listening and speaking drills administered largely on a home-study basis. After students had undergone a total of 180 separate listening ("phonematization") exercises, followed by 230 sound reproduction drills, Morton found that they exhibited "an extremely good pronunciation of Spanish sounds and sound groups" (p. 131). In many cases, the students had even learned to mimic the "pitch, breathing habits, and to some extent the resonant qualities" (p. 131) of the model speaker's voice.

Roertgen (1959) conducted an experiment in which college students of German attempted to learn a single Dutch sound through simple imitation of a model. One result was that "almost 30 percent [of the students participating in the experiment] could learn new sounds, after a very limited practice, without an explanation of their physiological basis, by simple imitation" (p. 591).

Although the studies reported above may give somewhat ambivalent testimony on the feasibility of student self-instruction in pronunciation, some of the results are encouraging, and the absolute necessity for a human teacher to take part in the pronunciation training process is somewhat questioned on the basis of those positive results obtained.

It is usually assumed that the student must be able to distinguish aurally between target language sounds and/or target and native language sounds in order to imitate sounds in the target language with any degree of accuracy.[1] Valdman (1961) considers the ability to make French-French phonemic distinctions as crucial to the learning of phonetically accurate pronunciation, and states that "until [the student] can consistently hear the difference between assis vs. assez or between mari vs. marée vs. marais, it is useless to ask for a closer approximation to the French model" (p. 262). Politzer (1965) states in his student handbook on foreign language learning that "pronouncing correctly implies an ability to hear correctly: you must hear 1) the differences between the foreign speech sounds and 2) the differences between them and the sounds of your own language that you are likely to substitute" (p. 89).

Even if it is assumed that discrimination ability is critical to the development of accurate target language pronunciation, there is still some difference of opinion as to whether the student would have to be trained in making these discriminations or whether the requisite discriminative ability would be possessed innately by the language student. In the first of two French discrimination training experiments, Pimsleur, Mace, and Keislar (1961) found that American subjects who underwent a

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[1] A recent unpublished experiment by Lawrence Mace has, however, found that the accurate student production of certain Chinese sounds can be acquired before the sounds are successfully discriminated by the student. (Personal communication.) Such a finding would suggest that the discrimination question is not yet completely settled.

short training sequence contrasting French and English /o / attained higher mean scores on a later discrimination test than did a control group which had been exposed to the French sound only. The implication of this finding was that students in the training group learned a more accurate discrimination of this sound than was initially available to them. However, in a second experiment contrasting /$\tilde{o}_f$ /, /$\tilde{a}_f$ /, and /$\tilde{\varepsilon}_f$ /, no significant difference in discriminative ability was found between those students who received discrimination training in the three sounds and a control group which listened passivly to the same sounds.

Lane (1964a), in discussing the discrimination question, suggests that much of the discrimination "learning" which takes place in foreign language training is simply a matter of transferring previously acquired discriminations to a new context. Supporting experiments in the discrimination of Thai tonemes (Lane and Schneider, 1963) and of certain Spanish phonemes (Lane, 1964b) showed an extremely rapid acquisition of the proper discriminations, suggesting that a transfer phenomenon rather than genuine learning was involved. However, in one instance (Spanish /rr / vs. English /r /), Lane found a more gradual acquisition of the desired discrimination, suggesting that in this case original learning had taken place.

All of the above studies share a practical drawback in that they are based on a restricted number of sounds; in view of the many different acoustic features represented by the various phonemes of a given language, it may be considered risky to draw conclusions based

on the examination of only a few sounds.

A more exhaustive discrimination training study (Suppes, Crothers, Weir, and Trager, 1962) tested the discrimination by American students of 26 Russian consonant pairs. Although a rather high initial discrimination level was found for all consonants (the average error rate for a group of "difficult" contrasts was only 22 percent), some learning did take place in the course of the experiment, with the rate of discrimination learning varying with the phonemes involved. On this basis, the authors compiled a rank order listing for discrimination difficulty of the consonant pairs. A later study of Russian vowel discrimination (Suppes, Crothers, and Weir, 1962) also found differences in discrimination learning rates among the various vowels tested.

An important experiment in the discrimination of French vowels has been conducted by Politzer (1961). The first part of his tape recorded discrimination test presented series of four one-syllable French words which were similar except for a single vowel phoneme; the students' task was to select the differing word. Examples of the contrasts presented are: /i_f / - /e_f / (les-les-lis-les), /$ɔ_f$ / - /o_f / (cctte-côte-côte-côte), and /u_f / - /y_f / (doux-du-doux-doux). The second section of the test presented similar distinctions imbedded in longer (two-syllable) contexts, for example: /i_f / - /e_f / (cirer-serrer-serrer-serrer). Items in the third section of the test contrasted a number of French vowels with their English counterparts (pique-peak-pique-pique), and the student was again asked to select the "different" word. In a final section, an absolute judgment situation was established

in which the student listened to one-syllable French or English words presented in isolation (qui; tip; Lee; foule) and marked them as "correct" or "incorrect" French words.

Considerable variation in discrimination difficulty was found among the different sound contrasts. In the first (French-French) section of the test, /e_f / and /∂_f / were discriminated with 100 percent accuracy, while the contrast /$\tilde{\varepsilon}$ / - /$\tilde{o}e$ / was successfully discriminated with a frequency of only 26.8 percent (chance level = 25 percent). Further, the difficulty of discrimination was found to vary appreciably depending on the discrimination task involved. The most difficult discriminations involved absolute judgments of French and English sounds presented in isolation. On the other hand, when French and English sounds were presented together for comparison, this discrimination task proved very easy: the most difficult contrast (/i_f / - /i_e /, as in pique-peak) was scored with 77.6 percent accuracy, and the average discrimination accuracy across all French-English sound contrasts was 92.9 percent.

In analyzing the relative contributions of the studies summarized above to a resolution of the debate over the necessity to teach the non-native student to discriminate target language sounds, either among themselves or in contrast to native language sounds, greatest weight should probably be placed on the studies dealing with a number of different sounds. On this basis, a general observation is that for certain sounds or sound combinations, a high level of accuracy in discrimination is observed even in the absence of explicit training.

In other cases, however, the appropriate discriminations are not so readily available and must presumably be learned by the foreign language student.

In the present experiment, the decision not to provide sound discrimination training prior to the self-shaping procedure was again dictated by considerations of experimental parsimony. For those French sounds which were found to be successfully imitated by American speakers under the simple imitation conditions established for the experiment, preliminary training in sound discrimination would be unnecessary and time-wasting. For those sounds which were not successfully imitated at the conclusion of the self-shaping period, preliminary discrimination training might be suggested as an auxiliary procedure; the contribution of this procedure to the successful pronunciation of these sounds could then be experimentally determined. Thus, for purposes of this experiment, preliminary training in sound discrimination was considered to be in the same general category as any other postulated pronunciation learning aid--to be employed only following the failure of the simpler method to produce the desired results.

A number of mechanical or electronic devices may be employed as aids to pronunciation self-training, and these devices may be of varying degrees of complexity. One step beyond the simple repetitive tape-loop procedure specified for this experiment would be the use of a "pause lever," a feature available on many tape recorders in current use. Mathieu (1962) advocates use of a student-controlled pause lever to provide whatever interval of time is desired by the student in

making his responses to recorded stimuli, and it is quite possible that individual control of the stimulus-response timing would facilitate the self-shaping procedure by comparison to a fixed-interval type of presentation. Frink (1964) also mentions the desirability of a variable timing device as an aid to student repetition practice, and gives tentative specifications for an "audio electronic repeater" capable of providing a variable length of pause as well as a variable number of repetitions of a given stimulus.

Another procedure which is currently used in many language laboratories involves the use of a second tape recorder to record the student's responses to the model sounds for later playback and comparison. Opinion is somewhat divided on the superiority of a playback provision over the one-time imitation of a presented stimulus. Pleasants (1963) makes a strong plea for the provision of playback facilities in language laboratory installations and states that "even if the tapes are excellent, a booth without student recording facilities at all times for all oral drills is a waste of money, time, and energy" (p. 7). Young and Choquette (1963) conducted an experimental study comparing four different language laboratory systems in the training of French pronunciation: immediate mimicry using 1) activated and 2) inactivated microphones; rehearing of responses following 3) short (1 1/2 second) and 4) long (several minutes) periods of delay. On the basis of generally nonsignificant differences in student performance under these four conditions, the conclusion was made that "the experiment had failed to demonstrate any differences

between treatments in efficiency for learning to pronounce except for possible lower efficiency on the part of the long delay condition" (p. 78). The authors do, however, suggest that the short delay playback procedure, which necessitated the use of electronically inferior recording equipment, was not fairly represented in the experiment and would merit further investigation.

Much more sophisticated types of instrumentation could probably be devised, as for example the elaborate computer-based system described in Lane (1964a) which is capable of extracting the "intonation, tempo, and relative amplitude parameters of a recorded stimulus pattern and of the subject's echoic response" (p. 279) and of presenting these differences visually to the student. However, in view of the cost and complexity of such systems, it is probably desirable, for practical reasons, to place emphasis on the development of simpler types of instrumentation which could be purchased and maintained by the average school system. Again, the use of any such instrumentation should properly be based only on demonstratively increased efficiency in student pronunciation training.

Deliberate formal instruction in pronunciation takes a variety of forms which on an a priori basis may be considered to have varying degrees of efficiency. A traditional procedure has been to make use of articulatory diagrams showing the position of lips, tongue, and other speech organs as they are placed for the rendering of the various target language sounds. In many cases, detailed verbal descriptions are also provided, as for example, the instructions of Pleasants (1962)

for the pronunciation of the French /f /: "Tongue, inactive; Lower lip, internal part comes in contact with upper incisors, thus completely covering lower incisors; Upper lip, does not touch lower lip; Corners of mouth, in position for accompanying vowel; Muscles, tense" (p. 62). The accuracy and validity of such close descriptions may be questioned in some cases: spectrographic analyses conducted by Pierce (1962) show that acoustically similar vowels may be produced through various combinations of tongue movement and lip rounding; Léon and Léon (1964) suggest that before the teacher takes detailed articulatory descriptions too closely to heart "il faut se rappeler qu'on peut pratiquement produire n'importe quelle voyelle et bon nombre de consonnes avec une articulation tout à fait différente de celle décrite habituellement" (p. 19).

At the other extreme are the rather casual articulatory descriptions (e.g., "tip of the tongue well forward in the mouth," "made with the tongue high in the mouth") which Sacks (1962) found characteristic of a number of Spanish textbooks, and which he criticized for their imprecision and presumed lack of pedagogical utility.

In the absence of controlled experimentation, it is difficult to appraise the pedagogical usefulness of articulatory diagrams and descriptions. Even assuming the general desirability of using such materials, the optimal amount of detail in the diagrams and associated verbal descriptions would be open to question. Possibly, a programmed audiovisual presentation of somewhat stylized articulatory diagrams accompanied by a carefully prepared and taped "lecture" would prove

of value in the teaching of certain sounds, assuming of course that the correct pronunciation could not be acquired through unaided self-shaping.

Another type of instruction which has considerable currency as well as intuitive appeal is the teaching of pronunciation "tricks" ("trucs," "conseils," "recettes pratiques") which would help the student to obtain an acceptable pronunciation of a given sound or at least to acquire a first-order approximation to that sound which could be refined through imitation practice. Léon and Léon (1964) suggest that a useful technique for teaching the French /y / is to have the student repeat a syllable containing the vowel /i / (such as /si /, /si /, /si /) and then by suddenly rounding the lips make an immediate change to /sy /. Mercier (1966) gives a possibly useful pronunciation trick for /R_f /: "prolonger /ɛ /, et en gardant la pointe de la langue collée contre les incisives inférieurs, remonter rapidement le dos de la langue vers le palais (comme pour K)" (p. 25).

Pronunciation training through the use of simple articulatory "tricks" is appealing in that it avoids "teaching about" the sounds and places primary emphasis on correctly positioning the student's speech organs by whatever means may be available. In the same connection, the use of certain "tricks" of a mechanical nature is occasionally suggested, including, for example, the placing of tissue paper close to the lips to check the degree of consonant aspiration, or use of a tongue depressor to keep the tongue tip low in the mouth during the pronunciation of certain vowels.

Many other examples of pronunciation "tricks" are available in the literature, and comprise a useful inventory of coaching procedures whose effectiveness could be tested on an experimental basis.

Procedure

As has been discussed, the intent of this experiment was to determine the extent to which each French sound not found to have a phonetically acceptable counterpart in English could be learned to a criterion of phonetic acceptability through the untutored imitation of model French sounds. The sound judging procedure used in this experiment was similar to that established for Experiment II in that the American students' imitations of model French sounds were presented to native French judges together with two French "decoy" sounds with which the tested sound was compared. The rationale underlying this judging procedure and the definition of "phonetic accuracy" which such a procedure affords has been discussed in Chapter 2.

Since none of the English phonemic counterpart sounds identified in Experiment I had been found to serve adequately at the French phonetic level (Experiment II), the suggested conclusion was that none of the English phonemic counterparts could be considered phonetically acceptable in French. This conclusion may be unwarranted for certain consonants whose phonetic acceptability may have been masked by the high "non-French" discrimination of the carrier vowel /i /.[1] However, for purposes of this experiment, it was considered preferable to adopt

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[1](see discussion, p. 94)

a "fail-safe" approach: rather than excluding certain intuitively acceptable consonants such as /m /, /n /, /f /, /z /, the entire set of 24 English-French phonemic counterpart sounds was included in Experiment III.

In addition to the 24 English-French phonemic counterpart sounds are the French sounds which do not have even a phonemic counterpart in English; presumably, the native speaker of English would have to be trained in the proper pronunciation of these novel sounds, since not even approximate sounds are available in his own language.

The final list of French sounds used in Experiment III is given in Appendix K and includes 34 sounds. This list corresponds, with two exceptions, to the French sound inventories usually presented in the literature.[1] The French /ʃ/ was not included in view of the unfortunate semantics of its use with the carrier vowel /i /, with which it would be constantly paired and pronounced in the course of the experiment, probably with disruptive results. Second, an /a / - /ɑ / distinction was not maintained;[2] rather, only the single anterior sound was used.

In Experiment II, the French decoy sounds had been recorded by having French speakers pronounce each sound from a printed list of example words; the same list-reading had also been used to obtain the English sounds. To obtain the decoy sounds for Experiment III, a list-reading technique would not have been suitable: since the task of the

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[1] See, for example, Fouché (1956) and Léon (1966).

[2] For discussion, see p. 40.

English speakers in Experiment III would be to imitate aurally modelled sounds, it was anticipated that their pronunciations would be more uniform in pitch level and intonation pattern than in the "reading aloud" situation of Experiment II. Thus, for Experiment III, it seemed advisable to have the French decoy speakers themselves "imitate" a French model voice, so that the pitch and intonation aspects of their own pronunciations would be correspondingly uniform when their productions were presented as decoys for the sounds imitated by the American speakers.

It is suggested that the imitation of model sounds by native speakers of a given language differs from the imitation attempts of students learning the language. In the case of the native speakers, it is not a matter of learning the correct pronunciation of the sound, but of initially identifying the sound involved, after which it becomes possible for the speaker to "imitate" the sound simply by giving his usual pronunciation of the phoneme in question. The experimental directions given would of course have some bearing on this performance: if emphasis were placed on producing a sound which was exactly like the stimulus sound, then an attempt at fine-grained imitation would be more likely. On the other hand, if the speaker were merely requested to say "the same sound," it could be expected that he would simply respond with his characteristic pronunciation of the sound in question. The purpose of providing a model sound for the French decoy speakers was not to indicate the "correct" pronunciation of the sound (to the contrary, it was experimentally desirable to incorporate slight

individual differences in realization) but rather to insure that the pitch and intonation characteristics of the pronunciations would be generally similar across speakers. Before the French speakers recorded their "imitations," they were told what sounds were involved and were shown example words embodying these sounds, so as to eliminate even the initial necessity to determine the phonemes in question.

The "model" sounds to which the French decoy speakers listened were recorded in Cambridge, Massachusetts by a native male speaker of French, aged 22, who had been born in Paris and had lived in Paris for approximately twenty years. The speaker recorded each of the French sounds involved in the experiment by speaking from a list of phonetic symbols (with which he was familiar). The pronunciations were timed by means of a small light placed near the microphone and arranged to flash briefly at intervals of 8 seconds. This timing system also introduced a slight click into the recording simultaneously with the signal light flash. This click was intended to serve later as an aural signal to the French decoy speakers that a sound was about to be pronounced. After each flash, the speaker pronounced one of the sounds on the list; vowels were pronounced alone, and consonants and semiconsonants were pronounced with the helping vowel /i /.

The recordings were made in a non-reverberant studio using a Sennheiser MD421 microphone and a Tandberg 74 recorder operated at 7 1/2 inches per second. The French sounds were practiced and re-recorded until both the experimenter and the speaker were satisfied as to the quality and accuracy of the productions. However, in

listening to the model sounds prior to the recording of the French decoy speakers, one of the French assistants to the project suggested that the original speaker had not made a sufficiently clear distinction between /œ / and /ə /, a fact confirmed through careful relistening. Fortunately, the experimenter had recorded two "backup" French speakers who had also applied for this recording job, and it was possible to substitute the /œ / and /ə/ of one of the extra speakers whose overall voice characteristics matched most closely those of the original speaker.

The model sounds were then incorporated into a repetitive stimulus tape as follows: the warning click and the model sound, together with a pause of approximately 5 seconds, were cut from the original recording tape and spliced end-for-end to form a continuous loop. Each loop was then placed on a Tandberg 74 recorder using a special tape support arrangement and was played back into a Tandberg 74B recorder also operated at 7 1/2 inches per second. By allowing the tape loop to repeat, a total of 13 repetitions of each sound were recorded onto continuous tape. On the stimulus tape, the overall presentation cycle was thus approximately as follows: click - 1/2 second pause - stimulus sound - 4 second pause - next click, through 13 repetitions of that phoneme. Similar cycles were recorded for each of the other French phonemes and were placed in sequential order on the stimulus tape.

The French decoy speakers used for Experiment III were all students at the lycée near Paris which had supplied decoy speakers for Experiment II. For Experiment III, a total of 49 different speakers

were recorded, of which 42 were ultimately retained.[1] None of these speakers had participated in the decoy sound recording for Experiment II.

Among the 42 speakers, all but one had been born in France,[2] and 35 had been born in Paris or within the Paris region (Seine et Oise). Twenty-eight of the speakers had travelled abroad, generally on short trips to England, Switzerland, or Spain. All had studied English at the lycée, though this is not felt to have had any bearing on their experimental performance since the task which they were asked to perform was simply to pronounce a number of French sounds. None of the speakers had speech or hearing difficulties as determined by a questionnaire item to that effect (see Appendix L), and neither the experimenter nor the French assistants noted any such problems with any of the speakers.

All recording of the French decoy speakers was done using the portable recording booth previously described. Each speaker entered the booth alone and stood before a Sennheiser MD421 microphone placed at a distance of approximately 12 inches. The speaker wore padded

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[1] It was necessary to reduce the number of speakers in this way so that the proper multiples of sounds and decoy speakers would be obtained for combination with the imitation attempts of the American speakers. Generally, the speakers deleted were those that had been recorded last, although in three cases, speakers with particularly "thin" voices were deliberately excluded.

[2] This speaker was born in Morocco and had lived there for eight years before moving to France.

earphones (Lafayette F767) which were "activated" so that the speaker could hear both the model sound and his own pronunciations. The headset volume for both the stimulus sounds and the speaker's own voice were varied within a slight range to suit the preference of the speaker; recording volume, however, was held as constant as possible for all speakers through close monitoring of the recording level indicator on the recorder (Tandberg 74).

Each decoy speaker pronounced a total of five different French phonemes (five continuous phonemes on the stimulus tape). For each phoneme, the speaker produced 13 phones in response to the single model sound which was repeated this many times on the tape. The recording process was continued until all speakers had been recorded, corresponding to at least seven 13-phone sets for each of the French phonemes.

It had originally been planned that the American speakers involved in the self-shaping procedure would simply imitate the sounds produced by the single French speaker who had served as the "model" for the French decoy speakers. However, since the decoy recording had in itself made available the typical productions of a number of French speakers, this provided an opportunity to produce a stimulus tape incorporating the productions of several different speakers. Although the pronunciations of a given phoneme by different native speakers would not be expected to vary greatly, slight differences in realization would be anticipated; thus, rather than restricting the student's imitation practice to the productions of a single speaker, it seemed

preferable to present the student with models that would vary slightly (and naturally) among themselves. On this basis, it was decided to use, as the stimulus sounds for imitation by the American speakers, a subset of the various sound productions of the decoy speakers.

On an essentially random basis, the 13-phone sets of six different French decoy speakers were retained for each phoneme. Within each set, the experimenter re-recorded onto individual recording cards (Appendix C) the "middle six" renditions of that speaker, so that for each of the 34 phonemes, 36 productions of that phoneme were available, representing six different phones by each of six different speakers.

For each phoneme, the 36 sound cards were arranged according to the design shown in Figure 2; this is actually a 6 x 6 Latin square which has been extended into a single vector. The capital letters refer to the six different speakers, and the subscript numbers indicate the first through sixth phones of a given speaker. Following this schema, the 36 sounds for each phoneme were re-recorded onto continuous stimulus tapes. A 3-second pause was provided between each of the stimulus sounds, during which the student was to make his response. In view of the short time interval between sounds, preliminary clicks or other such signals were not used.

Considerable thought had been given to the problem of individual differences in imitative performance on the part of the American speakers and the effect which this might have on the experimental results. Obviously, it would be necessary to have more than one American speaker pronounce a given phoneme, but in view of the large

number of phonemes involved, it was also apparent that any given increase in the number of speakers per phoneme would multiply by a factor of 34 the total number of speakers required for the experiment. For example, to provide 10 speakers per phoneme, a total of 340 different speakers would be involved. If the number of speakers per phoneme were set at 15, a total of 510 participants would be required. Students in such numbers who met the general age limits and who had in addition never studied French would be very difficult to obtain, particularly in the Cambridge, Massachusetts area, where junior-high school and elementary school instruction in French is quite common.

Further, any increase in the number of speakers would imply corresponding increases in the number of sound productions which would have to be judged. A basic initial decision had been to have each French listener judge all of the sounds involved in the experiment so that individual variations in judging ability would not differentially affect the scores assigned to the different sounds (as might have been the case if, for example, one group of judges were assigned half the phonemes and a second group the other half). Thus, an upper limit to the number of sound productions which could be incorporated into the experiment was the total which a single group of judges might reasonably be expected to score with good grace and continuing effectiveness. In this respect, it was felt that a total of six working hours, spread over two or three separate sessions, would be a reasonable maximum. With the use of the same triplet presentation and response-timing arrangement used in Experiment II, a six hour judging limit would

permit the scoring of approximately 1200 triplets, that is, 1200 presentations of an imitated sound and the two accompanying French decoys. With 34 separate phonemes, it would thus be possible to provide about 36 different presentations of each phoneme.

Given a maximum of 36 presentations for each phoneme, this total could be obtained through several different combinations of the number of speakers and the number of pronunciations (phones) per speaker; some examples are:

2 speakers, 18 productions each
4 speakers, 9 productions each
6 speakers, 6 productions each
9 speakers, 4 productions each
12 speakers, 3 productions each
18 speakers, 2 productions each

Although the general desirability of providing the greatest possible number of speakers for a given phoneme was recognized, certain experimental factors made it necessary to set a maximum of six speakers per phoneme: since it had been planned to measure improvement over time in the pronunciation of each phoneme, this necessitated the sampling of the speakers' responses at various points in the imitation sequence. The smallest feasible number of sampling points appeared to be three (beginning, middle, and end of the sequence); within each interval, an absolute minimum sample of two phones would be required, or a total of six productions per speaker. This requirement would in turn dictate an allocation of six speakers to each phoneme.

Even this limited allocation would have required the participation of 204 different speakers in order to test all of the 34 phonemes under examination, and it was not anticipated that this number of students who could meet the experimental requirements of age and lack of prior study of French could be made available within the participating school system.

It was thus decided that each American speaker would be asked to imitate two different sounds; such a procedure would reduce the number of speakers required to a workable total of 102, but would raise the problem of possible interaction effects between the sound pairs which a given speaker would imitate. If, for example, the two sounds to be imitated were /õ / and /ã /, the initial period of practice with /õ / might be expected to facilitate the pronunciation of /ã /, particularly if the speaker had "learned the secret" of nasalization in the course of his practice with the first sound. Some facilitation might also be expected for such pairs as /u / - /o /, which have in common the acoustic feature of non-diphthongization.

However, given the necessity of forming sound pairs, a reasonably safe approach to the interaction problem seemed to be to compose each pair of a vowel and a consonant. There was no reasonable basis to assume, for example, that the prior imitation of /u / would have a bearing on the speakers' pronunciation of /b /; similarly, it was not felt that the preliminary pronunciation of /e / would reasonably affect the speakers' pronunciation of /ʒ /, and so forth.

Since the phoneme set under study consisted of 15 vowels and 19

consonants, it was in two cases necessary to pair consonants. The pairs /ɲ/ - /p / and /ɥ/ - /k / were deliberately selected because of the widely differing articulatory characteristics of the elements in each pair.[1] The 30 remaining sounds were arranged into vowel and consonant pairs on a random basis; the final list of sound pairs obtained is shown in Table 12.

The American speakers for this experiment were obtained from a public high school system in the Cambridge, Massachusetts area. According to their answers to a background questionnaire (Appendix M) four of the 102 speakers had been born outside the United States (in Italy, Canada, South Africa, and Japan); these speakers considered themselves, nevertheless, as native speakers of English. The majority of participants had been born in Massachusetts. Sixty of the speakers stated that they had never travelled outside the United States; 35 had visited Canada for weekend or vacation trips, and the other seven reported travel to Italy, Mexico, Venezuela, Germany, and Switzerland.

Forty-six of the speakers had never studied a modern foreign language; 42 had studied Spanish for periods of one-half to three years; 12 had studied German from one to six years; and 2 had studied both Spanish and German. One speaker reported that he had studied French for "one week"; the remainder stated that they had never studied

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[1](For the /ɲ/ - /p / pair, the place and manner of articulation are alveopalatal continuant [nasal] and bilabial occlusive, respectively; /ɥ/ and /k / are alveopalatal continuant and velar occlusive, respectively.)

Table 12

French Sound Pairs for Experiment III

1)	/u /	/b /
2)	/e /	/ʒ /
3)	/o /	/d /
4)	/ɛ̃ /	/l /
5)	/y /	/t /
6)	/ɔ /	/w /
7)	/ə /	/v /
8)	/ø /	/j /
9)	/a /	/m /
10)	/õ /	/R /
11)	/ɛ /	/n /
12)	/œ/	/f /
13)	/i /	/s /
14)	/œ̃/	/g /
15)	/ã /	/z /
16)	/ʁ /	/p /
17)	/ɥ /	/k /

French.

Ages of the American speakers ranged from 15 to 20, but the great majority (93) were between 15 and 17. Mean age was 16.3, with a standard deviation of 0.94.[1]

The American speakers were recorded individually and in a pseudo-random order based on availability during study hall periods. Instructions were given orally to each speaker immediately before he was to record; the speaker was told that he would hear a certain French sound which would be repeated at short fixed intervals, and that he should imitate the sound as closely as possible each time it was presented.

It was emphasized that the French sound might be somewhat different from any English sound, so that it would be necessary to listen closely and to try to pronounce the sound as accurately as possible on each presentation. The speaker was also told that the sound would be repeated for a period of about three minutes;[2] following this, he would have a short break and would then be asked to pronounce one more sound.

The speaker then entered a special recording booth,[3] put on a set of padded earphones (Lafayette F767), and stood facing a microphone (Sennheiser MD421) at a distance of about 12 inches. The earphones were activated so that the speaker could hear both the stimulus sounds

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[1]Age range for the 42 French decoy speakers was 13 to 18, with a mean of 15.6 and standard deviation of 1.21.

[2]Actual running time for each sound was about 2 1/2 minutes.

[3]See p. 80 for description.

and his own reproductions. Adjustments in playback volume level were not made for individual speakers; rather, the volume levels for the stimulus sounds and the student feedback were fixed by the experimenter at a predetermined comfortable level approximating the volumes that would be present in normal face-to-face conversation.

When the speaker was in proper recording position and had adjusted his earphones, the booth door was closed and the stimulus tape for the first sound was played back from a Tandberg 74B recorder into the earphones, while the stimulus sound and the speaker's response were recorded onto separate tracks of a Tandberg 74 recorder operated at 7 1/2 inches per second.

Almost without exception, the speakers were found to give their response about one second after the end of the stimulus. A few waited as long as 1 1/2 seconds to make their response, and three or four of the 102 speakers responded in a "machine gun" fashion about one-half second or less after the end of the stimulus. In order to avoid transfer problems when the sounds were later recorded onto individual cards, the speakers who were found to respond in this way were immediately stopped and asked to wait slightly longer before making their response. With this very limited exception, all speakers were allowed to adopt their own response timing in imitating the model sound.

Immediately after the first sound tape had been completed, the speaker was invited to relax for a minute, either inside or out of the booth, while instructions were given for imitating the second sound. The speaker was told that the second sound would consist of a consonant

together with a helping vowel /i / (the experimenter pronounced a high, non-diphthongized /i / a few times in illustration). The speaker was urged to imitate both the consonant and the vowel as closely as possible but not to slight a careful pronunciation of the consonant, which might not sound exactly like any English sound.[1]

Following these instructions, the booth was again closed and the second sound was played for imitation. At the conclusion of this recording, the speaker was dismissed and a new student brought in on a relay basis.

The order of recording for the individual sound pairs was as shown in Table 12 (p. 138). After all the sound pairs had been recorded once, the next appearing speaker recorded the sound pair at the top of the list and the cycle was repeated. At the conclusion of the recording sessions, which extended over several days, a total of 6 speakers had been recorded for each of the 17 sound pairs, that is, for each of the 34 French sounds. Each speaker had imitated the stimulus sound 36 times.

As previously discussed, it was not possible for a single group of French listeners to judge each of the sounds (phones) produced by the American speakers in the course of the imitation session; on the contrary, a maximum sampling of six different phones had been indicated, to be drawn from the beginning, middle, and end of the imitation

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[1] Except for the example pronunciations of the carrier vowel /i /, the experimenter did not mention or pronounce any specific English sounds in the course of the experiment.

session. Since it was felt that the speaker might not be "in stride" until after a few repetitions of the stimulus sound, the first sample was set as the 4th and 5th sound of the sequence. The end sample was specified as the last two sounds (35th and 36th), and a point essentially equidistant from these two samples (20th and 21st sounds) made up the middle sample. The six sample phones for each speaker were re-recorded onto individual recording cards by playing back the original continuous tape from a Tandberg 74 recorder into the Laconic I recording deck (Appendix C). Recording cards were inserted at appropriate intervals to transfer the sampled sounds; in making this re-recording, playback and recording volumes were set at the same level as had been used for the earlier re-recording of the French decoy sounds.

To assemble the judging tape, random numbers generated by a computer program were assigned on a selection-without-replacement basis to the 1224 recording cards (representing 34 imitated phonemes x 6 American speakers x 6 phones per speaker). After the English sound cards had been arranged in the sequence dictated by this assignment, each English sound was paired with two corresponding French decoy sounds by drawing two cards from a thoroughly shuffled deck of French cards containing the phoneme in question. In the event that the same French speaker had rendered both decoy sounds for a given triplet, the decoy sound cards for that phoneme were again shuffled and a different speaker drawn for one of the original decoys. Thus, three different voices were always heard for each of the sound triplets. As a final

step, the order of presentation of the English imitation sound within each triplet was determined on the basis of the sequential appearance of the digits 1 to 3 in a large table of random numbers.

The 1224 sound triplets thus obtained were re-recorded onto continuous tape by playing back the recording cards from the Laconic I deck into a Tandberg 74 recorder operated at 7 1/2 inches per second. To cue the presentation of each sound triplet, a slight "click" was introduced into the tape at 15-second intervals by means of an electric timing circuit. After each click, the experimenter fed sound cards into the tape deck in such a way as to produce an overall cycle which was approximately as follows: click - 3 seconds - first sound - 3 seconds - second sound - 3 seconds - third sound - 4 seconds - next click.

The French - American Imitation sound tapes were judged by 12 native speakers of French obtained through contacts at the participating lycée. This group consisted of six men and six women, ranging in age from 19 to 30. None of these judges had participated in Experiments I or II. Seven of the 12 stated in a background questionnaire (Appendix H) that they had not studied English in a lycée; school study of English for the remaining five judges was not considered significant for purposes of the study.[1] Most of the judges had only slight non-school contact with English. One judge reported that he had been exposed "un peu" to spoken English outside of class, and the other 11 indicated that they had never or almost never heard spoken

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[1]See p. 87 for discussion.

English outside of class. Four judges reported restricted extra-curricular reading in English (one or two books, or an occasional magazine), and eight stated that they had done no reading in English outside of class. One judge had attended English clubs or English houses "un peu"; the remainder had no such contacts. None had studied English prior to the lycée, and only one of the judges had ever travelled to an English-speaking country (a two-week visit to England). None of the judges reported speech or hearing difficulties.

Judging of the 1224 French - American Imitation triplets required approximately six hours of actual working time, carried out in two separate evening sessions. It had originally been planned to administer the judging tapes through individual earphones as in Experiment II; however, equipment malfunction on the evening of the first judging session made it necessary instead to play the sounds through the loudspeakers of the Tandberg 74B tape recorder. This change is not felt to have adversely affected the judging conditions, since the loudspeakers for this recorder are of high quality and the room in which the judging took place (one of the lycée classrooms after hours) was quite free of distracting noises.

All judges sat conveniently close to the recorder at individual desks; each judge was supplied a Portapunch board and stylus, together with three-choice Portapunch cards (Appendix I) into which the responses to each triplet presented were punched by the judge.

Tape recorded instructions, in French, were played at the beginning of the first evening session. These instructions were the same as those

used in Experiment II (see Appendix J for text). The judges were told that they would hear three sounds: two of the sounds would be pronounced by native speakers of French, and one would be pronounced by a person whose native language was not French. The judges' task would be to select the "non-French" sound in each case. In case of doubt, the judge would still be required to make a response, using whatever slight acoustic clues were available.

After any additional questions by the judges had been answered (without giving any basic information other than that contained in the directions), the judging session began. Short rest breaks were provided at 30-minute intervals, during which the judges were advised not to discuss any details of the experiment. As previously mentioned, the entire judging required two evening meetings of about three hours each, exclusive of rest periods.

At the completion of the judging, all of the Portapunch cards were examined for proper punching; any card indicating an amended answer on the part of the judge was repunched to indicate the intended correct answer. Computer programs were then used to calculate summary data for sounds, judges, and imitation intervals.

Results and Discussion

Tables 13 and 14 show the judging results for the imitated French vowels and consonants, respectively. For each phoneme, the total number of correct discriminations across judges and sampling intervals

Table 13

Experiment III

Discrimination of Imitated French Vowels
by Indigenous French Listeners

Vowel[a]	Total Correct Identifications Across Judges			
	Across 3 Sampling Intervals[b]	Interval 1[c]	Interval 2	Interval 3
/ɔ /**	148 (34.3)	38 (26.4)	64 (44.4)	46 (31.9)
/ɛ /*	196 (45.4)	53 (36.8)	69 (47.9)	74 (51.4)
/œ̃/	243 (56.3)	83 (57.6)	91 (63.2)	69 (47.9)
/e /**	246 (56.9)	69 (47.9)	82 (56.9)	95 (66.0)
/ã /	247 (57.2)	74 (51.4)	84 (58.3)	89 (61.8)
/ɛ̃ /	266 (61.6)	95 (66.0)	75 (52.1)	96 (66.7)
/ə /**	277 (64.1)	77 (53.5)	107 (74.3)	93 (64.6)
/o /**	301 (69.7)	114 (79.2)	98 (68.1)	89 (61.8)
/õ /	306 (70.8)	104 (72.2)	89 (61.8)	113 (78.5)
/œ/	310 (71.8)	113 (78.5)	103 (71.5)	94 (65.3)
/a /	312 (72.2)	104 (72.2)	99 (68.8)	109 (75.7)
/y /**	319 (73.8)	94 (65.3)	124 (86.1)	101 (70.1)
/ø /	323 (74.8)	109 (75.7)	104 (72.2)	110 (76.4)
/i /	327 (75.7)	112 (77.8)	105 (72.9)	110 (76.4)
/u /	338 (78.2)	108 (75.8)	120 (83.3)	110 (76.4)
Mean:	277 (64.4)	90 (62.5)	94 (65.3)	93 (64.6)
(S.D.:)	(52.3)	(24.3)	(18.0)	(19.1)

Note.--Significance levels for interval differences indicated by:
* = $p < .05$; ** = $p < .01$

[a]In order of increasing discrimination (across 3 intervals).

[b]Percentages given in parentheses. Maximum possible score = 432 (6 speakers x 2 imitations x 3 intervals x 12 judges). Chance level = 144 (33 1/3 percent).

[c]For each interval, maximum possible score = 144 (6 speakers x 2 imitations x 12 judges). Chance level = 48 (33 1/3 percent).

Table 14

Experiment III

Discrimination of Imitated French Consonants
by Indigenous French Listeners

Consonant[a]	Total Correct Identifications Across Judges			
	Across 3 Sampling Intervals[b]	Interval 1[c]	Interval 2	Interval 3
/j /	178 (41.2)	62 (43.1)	57 (39.6)	59 (41.0)
/ʃ /	220 (50.9)	75 (52.1)	71 (49.3)	74 (51.4)
/w /*	259 (60.0)	9? (68.8)	83 (57.6)	77 (53.5)
/v /	268 (62.0)	84 (58.3)	95 (66.0)	89 (61.8)
/R /**	279 (64.6)	79 (54.9)	112 (77.8)	88 (61.1)
/ɥ /	280 (64.8)	100 (69.4)	84 (58.3)	96 (66.7)
/z /**	282 (65.3)	79 (54.9)	111 (77.1)	92 (63.9)
/p /	287 (66.4)	97 (67.4)	108 (75.0)	82 (56.9)
/f /	290 (67.1)	102 (70.8)	91 (63.2)	97 (67.4)
/g /	298 (69.0)	106 (73.6)	103 (71.5)	89 (61.8)
/m /	306 (70.8)	92 (63.9)	105 (72.9)	109 (75.7)
/n /**	310 (71.8)	115 (79.9)	86 (59.7)	109 (75.7)
/b /	316 (73.2)	96 (66.7)	119 (82.6)	101 (70.1)
/k /	318 (73.6)	105 (72.9)	110 (76.4)	103 (71.5)
/ʒ /	324 (75.0)	109 (75.7)	109 (75.7)	106 (73.6)
/l /*	336 (77.8)	121 (84.0)	99 (68.8)	116 (80.6)
/t /	346 (80.1)	114 (79.2)	118 (81.9)	114 (79.2)
/d /**	350 (81.0)	125 (86.8)	99 (68.8)	126 (87.5)
/s /	371 (85.9)	117 (81.3)	123 (85.4)	131 (91.0)
Mean:	296 (68.5)	99 (68.8)	99 (68.8)	98 (68.1)
(S.D.:)	(44.3)	(17.4)	(17.6)	(18.6)

Note.--Significance levels for interval differences indicated by:
* = $p < .05$; ** = $p < .01$

[a]In order of increasing discrimination (across 3 intervals).

[b]Percentages given in parentheses. Maximum possible score = 432 (6 speakers x 2 imitations x 3 intervals x 12 judges). Chance level = 144 (33 1/3 percent).

[c]For each interval, maximum possible score = 144 (6 speakers x 2 imitations x 12 judges). Chance level = 48 (33 1/3 percent).

is shown, as well as the total correct discriminations across judges for each of the three sampling intervals (beginning, middle, and end of the imitation sequence). In each case, higher figures indicate a greater frequency of selection of the American imitation sound as the "not French" sound of the stimulus triplet, that is, a more accurate discrimination of the imitated sound.

An immediate observation is the very wide among-sounds range in the discrimination scores, for both vowels and consonants. In the vowel data, the average discrimination across imitation levels for /ɔ / was only 34.3 percent (chance level 33 1/3 percent). This figure suggests that the sounds which the American speakers produced in imitation of /$ɔ_f$ / (to the extent that their sampled productions may be considered representative) were virtually indistinguishable to the French judges from productions of the same phoneme by native speakers.

At the other extreme, the high discrimination level for /u / (78.2 percent) suggests that the imitations of this phoneme by the American speakers were quite easily discriminated from real French sounds.

A similar situation may be observed for the consonants, for which the percentage range in discrimination scores is 44.7, as compared to 43.9 in the case of the vowels.

A second observation, for both the vowel and consonant data, is the apparent lack of patterning in discrimination scores across the three imitation intervals. If improvement in pronunciation quality

for a given phoneme had taken place in the course of the speakers' imitations, a steady decrease in discrimination score for that phoneme would be expected across the three intervals. Among the vowels, this trend is observed on only two occasions (for /o / and /oe /), and only three consonants (/w /, /g /, and /ʒ /) exhibit a steady decrease in discrimination scores. On the other hand, an unanticipated increase in discrimination scores (which would presumably reflect worsening pronunciation) is observed for several phonemes, (/ɛ /, /e /, /ɑ̃ /; /m /, /s /), and in a number of other cases, the middle interval scores suggest "improvement" or "deterioration" relative to the other two intervals.

Although there appeared to be no discernible patterning in discrimination scores for the three intervals, one-way analyses of variance were conducted for the vowel and consonant data. In this analysis, the groups were the three imitation intervals and the observations were the discrimination totals for each sound under the appropriate intervals. A nonsignificant difference ($F < 1.0$) in total discrimination scores across the three intervals was found for both vowels and consonants.

One-way analyses of variance were also conducted for each of the vowel and consonant phonemes taken separately;[1] significant differences among intervals for individual phonemes are shown in Tables 13 and 14.

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[1](Groups for this analysis were the three imitation intervals; observations were the discrimination totals for each of the 12 judges for the sound and interval in question.)

Although statistically significant results may be observed in several cases, their practical interpretation is difficult in light of the apparently random patternings. Among the vowels, there is for only one phoneme (/o /) a significant progressive decrease in discrimination scores; among the consonants, there is similarly only one phoneme (/w /) which shows a significant trend in the direction of continual pronunciation "improvement." On the other hand, there are among the vowels two instances of a significant progressive "worsening" in imitative performance (/ɛ /, /e /), and for both vowels and consonants, several of the significant differences appear to reflect atypical discrimination scores for the middle interval.

In view of these generally inconclusive results for imitative improvement in the course of the self-shaping procedure, it seemed advisable to investigate in some detail the actual nature of the responses made by the American speakers in imitating the French sounds presented. The experimenter thus relistened to the 36-sound imitation sequences of all of the American speakers, that is, the productions of the six speakers for each of the phonemes tested. In addition to shedding some light on the statistical outcomes of this experiment, the following descriptions may be of interest in that they represent typical performances of naïve American speakers in imitating the French sounds involved.

The speakers imitating /i_i / all diphthongized this sound to some extent, and three of these speakers produced responses which were virtually indistinguishable from a regular American /i /. The other

three speakers diphthongized to a lesser extent, but there were nonetheless perceptible differences in this respect from the productions of the French decoy speakers.[1] Most of the American speakers' productions of /i / (across speakers and within imitation sequences) were in addition somewhat low in timbre; this was especially true of one speaker whose imitated sounds approached /I / on a number of occasions.

French /e / was also characteristically diphthongized by the American speakers. Only one of the six speakers avoided diphthongization; his productions of /e / were quite accurate except for a slightly lower timbre which was apparent only on close listening. At the other extreme, one speaker produced on all occasions a highly diphthongized sound which appeared to be a frankly American /e /. In imitating /e_f /, three of the speakers initially produced /ε /[2] or a

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[1]The stimulus sounds and the American speakers' responses had been recorded on separate tracks; both were played back in the course of the relistening.

[2]Phonetic symbols, as used in describing the American speakers' imitations, indicate those sounds which were considered closest to the speakers' actual productions. Here, for example, it is not suggested that the speaker pronounced a completely accurate French /ε /, but simply that he produced a sound which approximated /ε_f / (as opposed to some other vowel). In most cases, the language subscripts have also been dropped in keeping with the approximate nature of the transcription.

sound only slightly higher than /ɛ /, which was continued for five or six imitations and then gradually raised in timbre; the change in timbre, however, was accompanied by diphthongization. On the whole, only one speaker was felt to have produced an accurate /e_f /, and this achievement was not considered an effect of training, since a close approximation of the French sound was noted from the beginning of the imitation sequence.

The French /o / appeared to be a difficult sound for all six speakers, and none was considered to have attained a high, undiphthongized pronunciation in the course of his imitation practice. Initial responses to the model sounds were quite varied. One speaker immediately pronounced a typical American /o / which was reduced slightly in diphthongization near the end of the sequence; initial productions of the other speakers were all quite low (approximating /ɔ / or /ə /). In most cases, these imitations later rose in timbre, but the rise in timbre was again accompanied by diphthongization to a greater or lesser extent. One speaker failed to produce even a semblance of /o_f /; after considerable initial variation between /ɔ /, /U /, and /ɑ/, his productions stabilized at a slightly low and diphthongized /u /.

The French /a / appeared to present fewer problems for the American speakers. Three speakers immediately produced an /a / of correct timbre which was maintained throughout the sequence. The imitations of the other three speakers were also quite accurate except for infrequent productions of /ɔ /, particularly during the first half

of the imitation sequence. In one case, however, occasional production of /ə / continued throughout the sequence.

French /ɛ / was also generally well imitated. Five of the six speakers for this sound produced an undiphthongized sound of the correct timbre from the beginning of the sequence. In four of these cases, some tendency toward a diphthongized pronunciation was observed later in the sequence, although the experimenter could detect no general change in the stimulus sounds. Possibly, inattention brought about by a lack of "challenge" in the imitation of this sound induced the speakers to relax their pronunciations somewhat after the first minute or so of imitation. A sixth speaker missed the correct timbre throughout, and pronounced instead a diphthongized American /e /.

Two of the speakers who imitated /u_f / produced a lax, diphthongized, typically American /u / throughout the imitation sequence. Another speaker initially varied between /o / and /u / (both sounds somewhat low), and then changed to a higher, diphthongized /u / in mid-sequence and later pronunciations. Another speaker produced a low, non-diphthongized sound approximating /ɔ /, a pronunciation which remained unchanged throughout. Two other speakers exhibited considerable variation, apparently searching for the correct timbre: one of these speakers initially pronounced an open /ɔ / which was changed to /U / and somewhat later to a non-diphthongized /u / which was however somewhat lower than the French models; the other speaker produced /ɔ / and /U / at the beginning of the sequence, which was followed by a sound approximating an undiphthongized /o / and continued

throughout. A high, undiphthongized /u_f / was not acquired by any of the six speakers in the course of the imitation practice.

French /ø / was troublesome for most of the American speakers. Four speakers produced a sound which approached the correct timbre but was audibly more lax than the French models. In two of these cases, many of the productions were also r-colored. The two other speakers failed even to approximate the correct sound: one produced diphthongized sounds varying betwen /ɛ / and /e /, and the other pronounced a diphthongized /e / throughout except for an occasional /i /, which was also diphthongized.

Considerable variation in response was observed for /$œ_f$ /, both among speakers and within individual imitation sequences. This may be due in part to the somewhat greater variation exhibited by the French speakers themselves in pronouncing this sound. Since /$œ_f$ / normally appears only in closed syllables, several of the French decoy speakers experienced some difficulty in producing this sound correctly in isolation. Thus, the pronunciations of the French speakers were not uniformly /œ / (as this sound would have been pronounced by a trained phonetician) but varied somewhat among /œ / and /ə /, with an occasional rendering of /a /. It is probable that this variation in the model sounds contributed to the difficulty in imitation shown by the American speakers, who were found to produce such sounds as /ɛ /, /ɑ /, /e /, (r-colored) /œ /, /æ /, /I /, and /i / in their attempts to imitate the French models. Although the American pronunciations exhibited even greater variation than was found in the French models--

suggesting that the American speakers might have experienced difficulty even in the presence of satisfactorily uniform stimuli--the safest interpretation would be to consider the imitation results for /œ$_f$/ to be inconclusive as a result of experimental factors.

French /ɔ/ and /ə/ are two other vowels which do not normally appear in isolation: /ɔ/ usually appears only in closed syllables; /ə/ appears in open syllables (me, te, se), but not in isolation. Thus, the experimental setup, while valid for the other vowels tested, presented these two sounds (as well as /œ/) in an artificial context which might be anticipated to pose some pronunciation problems for the French speakers. The actual productions of the French speakers with respect to /œ/ have already been noted; in the case of /ɔ/ and /ə/, some variation in pronunciation was also observed. The French pronunciations of /ɔ/ varied in timbre from the quite open sound usually given as the model pronunciation to a somewhat closer sound which although discernible from the high, regular /o/ on careful listening was nonetheless clearly different from the more open pronunciations of the sound. The French speakers' pronunciations of /ə/ tended in some instances toward /ɑ/, although the pronunciations of this sound were on the whole more uniform than in the other two cases.

As in the case of /œ/, a cautious interpretation of the American speakers' responses in imitating /ɔ$_f$/ and /ə$_f$/ is urged; with this reservation, the responses of the American speakers to these two sounds were as follows: the speakers imitating /ɔ$_f$/ tended for the most part to pronounce /ɑ/, even in cases where the stimulus sound

had distinctly been /ɔ /. A probable cause is the occasional pronunciation of /ɑ / as the French stimulus; this readily imitated sound (as judged by the American responses to the rather similar /a /) may have been seized upon by the American speakers as constituting the sound in question, whereupon less attention might have been paid to some of the other stimulus sounds. Two of the American speakers, however, imitated all of the stimulus sounds quite closely, that is, altered their own pronunciations to reflect the different timbres of the stimuli.

Responses to /ə$_f$ / varied more appreciably, even though the stimulus sounds were relatively uniform. One speaker initially pronounced /ɑ /, then changed rather quickly to /ɛ / and again to /æ /, which was continued throughout with an occasional production of /ɑ /. A second speaker pronounced /ɛ / throughout, except for an occasional approximation of /ə /, and two other speakers were also found to select /ɛ / as the most common pronunciation, varying on occasion to /I / or a lax /ø /. One speaker pronounced /ə / throughout, with occasional r-coloring, and another produced a rather close /ø / on most of the presentations, with an occasional production of /I /.

The American speakers' imitations of the French nasals /ɛ̃ /, /ɑ̃ /, /ɔ̃ /, and /œ̃ / showed a rather interesting result which was consistent across all four sounds: in each case, the presence of nasality in the speakers' responses appeared to be a function of the individual speaker rather than an effect brought about by continued imitation. Those speakers who reliably produced nasalized sounds (of whatever quality)

in response to the French stimuli did so either from the beginning of the imitation sequence or no later than the fourth or fifth presentation. In contrast, speakers who did not nasalize their productions from the beginning failed to do so at any point throughout the imitation sequence, or in some cases, produced very infrequent and apparently sporadic nasalized sounds imbedded in a much greater number of purely oral sounds. Of the 24 speakers who imitated nasal vowels, 9 went through the entire series of 36 imitations without once producing a nasalized sound; 7 others produced a nasalized sound only on a few occasions, and the remaining 8 either nasalized throughout or following the first few presentations.

The sounds produced by the "non-nasal" speakers (including those speakers giving only randomly nasal productions) were on some occasions the correct oral analogs of the sounds in question: for example, two of the speakers imitating /õ / pronounced a (diphthongized) /o / throughout the sequence; another speaker who imitated /ɑ̃ / produced an oral /ɑ / which was continued without change. More frequently, however, even the correct timbre of the stimulus sound was not obtained, and the speakers' pronunciations varied widely in the course of the imitation sequence. One of the "non-nasal" speakers imitating /õ / pronounced sounds approximating /o /, /ø /, /ɛ /, /i /, /e /, and /ɔ /; another speaker produced /e /, /ɔ /, /ɑ /, and /ɛ / in response to /õe$_I$ /; a third speaker gave /ø /, /ɛ /, /I /, and a highly diphthongized /e / in imitating the same sound.

Only one of the speakers in the "initially nasal" group succeeded

in producing a consistently acceptable sound; this speaker produced an accurate /ɑ̃ / almost from the beginning of the imitation sequence and continued to do so throughout, with only occasional slight deviation. Productions of the other "initially nasal" speakers were either varied incorrect attempts at the correct timbre or persevering productions of a single incorrect sound; typical in the second case are the productions of one "initially nasal" speaker who pronounced /ɛ̃ / almost exclusively in response to a model /õ /.

The French /y /, which is usually considered along with the four nasal vowels to be a novel sound for American speakers, proved difficult for the six students who imitated it during the experiment. A sound approximating /I / was initially produced by three of the speakers, and in two of these cases, this sound was continued throughout the imitation sequence with only occasional interspersion of some other sound, usually a rather lax /ø /. (The third speaker produced /I / until about midway in the imitation sequence and then adopted a lax /ø / which was continued to the end of the sequence). Two other speakers initially produced /ø / and continued with this pronunciation throughout the sequence; in both cases, some of the /ø / responses were also r-colored. The sixth speaker searched among /i /, /u /, and r-colored /ø /, and in no case approximated the correct sound.

With respect to the American speakers' imitation of the French consonants and semiconsonants, aural evaluation of these productions tended to confirm the experimenter's original impression that most of the American speakers had not imitated the carrier vowel /i / with

complete accuracy. Across consonant-carrier vowel pairs, most speakers produced an /i / which was at least slightly lower than that of the French models. Diphthongization was also usually noticed, although the extent of the diphthongization varied with individual speakers. On the assumption that the French judges were at least as perceptive of these vowel differences as the experimenter, it can be suggested that they were on many occasions able to identify the imitated consonants as "not French" simply on the basis of differences in the carrier vowel. Such discriminations would of course mask the presumed inherent acceptability of certain consonants (such as /v /, /f /, /z /) and would also raise the discrimination levels for all consonants to some extent. In interpreting the verbal summaries of consonant imitation performance given below, the reader may wish to consider for each consonant whether carrier vowel discrimination or patent mispronunciation of the consonant itself would be suggested as the primary basis for its identification as "not French": in the absence of experimentally unequivocal consonant results, a verbal description of the speakers' imitations may be of some value.

Almost without exception, the American speakers who imitated French /p /, /t /, and /k / aspirated these consonants throughout the imitation sequence. One of the speakers imitating /p / initially aspirated the consonant quite strongly, but in about mid-sequence adopted a softer pronunciation with no apparent aspiration. The other 17 speakers who imitated these consonants all aspirated them to some extent throughout the imitation sequence.

The speakers who imitated /p / and /t / apparently had no difficulty in determining the phoneme involved; all pronounced /p / or /t / from the beginning of the imitation sequence. However, in imitating /k /, several of the speakers failed to select the correct phoneme, at least initially. One of the six speakers imitating /k / produced this sound continually from the beginning of the sequence, but three other speakers initially produced /t /, which they continued to pronounce on each presentation of the /k / stimulus. A fifth speaker pronounced /t / initially and then changed to /k / near the end of the imitation sequence; the sixth varied his productions throughout the sequence among /k /, /t /, /dʒ /, and /d /.

A similar effect is observed for the imitation of the voiced analogs /b /, /d /, and /g /. In no case were the speakers who imitated /b / and /d / found to produce any other consonant; however, three of the speakers imitating /g / initially pronounced /d / and changed to /g / only after several stimulus sounds had been presented. One of these speakers also pronounced /t / several times in the course of his imitations. A fifth speaker initially produced /g /, then alternated, with obvious hesitation, between /d / and /g / throughout the imitation sequence. The responses of the sixth speaker were initially /d / and were later interspersed with /b / and /d /.

These results are somewhat surprising in that both the /k / and /g / stimulus sounds appeared quite unambiguous to the experimenter, and it had been expected that the American speakers would have no difficulty in identifying either phoneme. Additional experimentation

in the reception of French /k / and /g / by untrained American listeners would be of interest: if the effects observed in this experiment were found to be consistent, discrimination training for these two consonants would be suggested.

None of the consonants /n /, /m /, /s /, /z /, and /v / occasioned the speakers' selection of some other phoneme, except for the occasional misinterpretation of the very early (first or second) stimuli; further, no perceptible difference in the French models and the imitated consonants could be detected by the experimenter, although the possibility of such discriminations by the French judges cannot be ruled out.

A much more salient basis for the "discrimination" of these consonants appeared to be the carrier vowel itself. In only three cases (among 30 speakers) did the experimenter consider that the carrier vowel had been imitated accurately; in all other cases, the speakers' promunciations of the model /i / sounds were slightly lower than the French models and usually diphthongized to some extent. Diphthongization was particularly apparent for the imitated /s /, in which three of the speakers were noted as having badly diphthongized the carrier vowel. This is probably a speaker sampling effect, since the speakers producing /z / (which parallels /s / in place and manner of articulation) did not diphthongize the carrier vowel to a noticeably greater extent than did the speakers for other consonants.

The speakers' imitations of the French /l / appeared to be uniformly of the retroflexed American variety,[1] and were audibly different from

[1](see Delattre, 1965, pp. 88-90)

the French models. All six speakers persevered in this pronunciation, and no improvement was noted in the course of the imitation sequence.

For the French /f /, an apparent problem in discrimination was noted for four of the speakers who imitated this consonant. Two of the speakers produced the correct phoneme throughout the imitation sequence, but the other four speakers produced /s / on several occasions (not necessarily at the beginning of the sequence) and two of these speakers also pronounced /z / from time to time.

The American speakers' pronunciation of /ʒ / was relatively accurate. Most of the speakers produced the correct phoneme from the beginning, although one speaker initially pronounced /z /, which was changed to /ʒ / after a few repetitions. The imitated /ʒ / sounds were however usually less forcefully voiced than the French models, which may have been distinctive to the French judges. Pronunciation of the carrier vowel following /ʒ / was on the whole somewhat lower in timbre than had been the case with the other consonants, and three of the six speakers tended to pronounce a carrier vowel only slightly higher than /I /. A possible articulatory correlate is suggested in that the accurate pronunciation of /ʒ / requires, or is at least facilitated by, lip rounding and fronting, whereas a high French /i / is more easily produced with the lips retracted and spread. It is of course also quite possible that speaker sampling factors were responsible for this result, and no reliable conclusion can be made in this respect.

The French /R /, as might have been expected, was quite inaccurately rendered. All six of the speakers who imitated this sound pronounced

/z / and/or /v / during about the first 10 repetitions of the model sounds. One speaker continued to pronounce /z / almost until the end of the imitation sequence and then attempted various velar or glottal sounds whose exact description would be quite difficult. The other five speakers attempted to approximate the sound much earlier in the sequence, but with little apparent success. It is interesting to note that none of the speakers produced a regular American /r / as his imitation of the model sound; one speaker, however, pronounced an American /r / to which he added glottal frication in an attempt to imitate the French sound.

The American speakers imitating /ʁ / had varied success: two of the speakers pronounced /ʁ / from the beginning of the imitation sequence. The other four initially pronounced /n /; of this group, one continued to pronounce /n(i) / on every occasion, while the others unsuccessfully attempted to produce /ʁ / by altering not the consonant but the carrier vowel: modifications of the carrier vowel included an appreciable lowering of timbre and in some cases, added nasalization. Except for one speaker who pronounced a sporadic /ʁ / on two or three occasions in the course of his imitations, the four speakers who did not pronounce /ʁ / initially also failed to do so throughout the imitation sequence.

The semiconsonants /j / and /w / were in general easily imitated from the beginning of the imitation sequence, but there were noticeable differences in the pronunciation of the carrier vowel for all but one speaker, who accurately imitated /w / and the carrier vowel throughout.

French /ɥ(i) /, in contrast, was not closely approximated by any of the six speakers. A common initial pronunciation was /wi /, later modified to /ui / or /uwi /; one speaker, however, pronounced /ri / throughout. In no case was the "trick" acquired of pronouncing a /y / followed immediately by the vowel; this is not surprising in view of the lack of success which the speakers for /y / had in pronouncing this sound itself.

On the basis of these relistening observations, it is possible to make certain comparisons between the general characteristics of the speakers' imitations and the statistical results obtained. The tendency of most speakers to diphthongize the carrier vowel /i / and also the other vowels particularly susceptible to diphthongization (/e /, /o /, /u /)[1] was presumably distinctive to the French judges. In the case of the helping vowel, this would have resulted in unreasonably high consonant discrimination scores; in the case of vowels presented in isolation, the discriminations would have been legitimate, but would nonetheless have helped to raise the discrimination scores for these sounds to the rather high levels observed.

The production of completely incorrect phonemes (for example, /d / for /g /, /ø / for /y /, /ɛ̃ / for /ɔ̃ /) was observed for many speakers, and this factor would with little doubt have raised discrimination scores appreciably. For example, the one speaker who pronounced /ɛ̃ / rather than /ɔ̃ / each time the stimulus sound was presented could

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[1] A certain amount of diphthongization was also found for several other vowels.

have contributed as many as 72 points to the discrimination total for that sound (6 productions x 12 judges); this would correspond to 16.6 percent of the total discrimination score.

The speaker response protocols also show wide variation among speakers in their ability to imitate the sounds presented; this lack of homogeneity in response tends to question the initial assumption that as few as six speakers per phoneme would be sufficient to balance, across sounds, individual variation in sound imitation proficiency. The three speakers who pronounced /s / with a badly diphthongized carrier vowel could have added as much as 50 percentage points to the discrimination score for this consonant; if the same speakers had happened to imitate some other consonant (such as /b /), this sound might then have appeared at or near the top of the discrimination scale.[1]

In addition to speaker sampling factors are those of sound sampling within the three imitation intervals. The sampled responses of speakers who varied their productions widely in the course of the imitation session would be particularly troublesome in this respect, since a fairly accurate response might be sampled early in the sequence, while a quite unacceptable sound might have been pronounced at the time of the second or third sampling. The sampling of a larger number of phones at each interval might have helped to identify trends more accurately,

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[1] It should be mentioned here that the speaker sampling factor does not apply to relative discrimination figures for Experiment II, since these figures were based on the pronunciation of each of the English sounds tested by all of the speakers.

but would have either imposed a much greater burden on the French judges or required a change in other experimental parameters (number of sounds, number of speakers per sound). Although the present study had deliberately sought to include all of the French phonemes, a useful procedure for further research using this general technique might be to reduce the total number of sounds tested in favor of increased numbers of speakers per phoneme and a larger sampling of responses for each speaker.

In general, the experimenter feels that the sound judging system established for this experiment was simply too "high powered" for the input data involved--the initial imitation attempts of untrained American students. Whenever the two real French sounds were paired with an imitation sound which was grossly mispronounced (or which had even been rendered as some other phoneme), the French judges could have been expected to have little difficulty in identifying the "non-French" sound. Although the judges may have been challenged in some cases, the experimenter suspects that most of the discriminations were made without difficulty as a result of the obvious disparity between the American imitation and the two French models.

On the other hand, the sound judging procedure used in this experiment might find a valuable application at higher levels of pronunciation training, that is, when the student has already become capable of imitating French sounds consistently and with reasonable accuracy. In this case, the acquisition of a "perfect" pronunciation could be reasonably and logically tested by this procedure, and would

be evidenced by no greater than random discriminations on the part of the French judges. At this higher level, it would also be feasible to test the pronunciation of whole words (or even phrases) rather than the production of a single sound.

Certain remarks may also be made on the overall results of the self-shaping technique as it was embodied in the deliberately simplified conditions of this experiment. A basic observation is that tangible pronunciation improvement did not take place in the course of the imitation session. This is <u>not</u> to say that all of the tested sounds were badly imitated: on the contrary, many consonants were considered to have been accurately produced, and certain vowels (/a /, /ɛ /) also appeared to have been generally well imitated. In addition, a few individual speakers gave rather accurate imitations of other sounds. The point intended here is not that there were no accurate pronunciations, but that they were usually made throughout the sequence rather than learned in the course of the imitation session.

In the case of the unacceptable pronunciations, the speakers' responses appeared to fall into two general categories. On the one hand, some speakers tended to alter their pronunciations continually during the course of the imitation sequence. For example, one speaker who imitated /ɔ̃ / produced a number of different phonemes (/o /, /ø /, /ɛ /, /i /, /e /) in the course of his imitations, while another speaker imitating the same sound never departed from a diphthongized /o /. Two speakers who imitated /u_f / pronounced a diphthongized American /u / throughout, while others varied their pronunciations

more widely in their attempts to match the French sound. Similar results were also seen for a number of other sounds.

Although a rigorous study of such a phenomenon would require further research, it might be suggested that relative discrimination ability would be one of the determinants of response pattern. There would be no reason for a speaker to alter his pronunciations if he felt that they were acceptable renderings of the sound heard. On the other hand, a speaker who could hear a clear difference between his own productions and the model sounds might vary his pronunciations considerably in an attempt to match the stimuli presented. This willingness to "experiment" might depend to some extent on individual personality factors: a speaker who was willing to take the risk of making "odd" noises might vary his responses more widely than would another speaker who would be easily embarrassed in this respect; indeed, it is possible that some of the perseveration noted in this experiment resulted from the speaker's desire to avoid embarrassment rather than the inability to detect the inadequacy of his response. Further experimentation in this area, possibly a clinical study of individual speakers' reactions to various imitative tasks, would be of value.

A basic conclusion for the self-shaping portion of the study is, thus, that the imitation practice afforded by 36 presentations of model stimuli did not appear to benefit the speakers in their production of the sounds in question, either because the sounds themselves were closely imitated from the outset, or more commonly, because little

tangible improvement in pronunciation was considered to have occurred in the course of the imitation session.

It might be suggested that the imitation period was not long enough, and that greater improvement would have taken place after five or ten minutes of pronunciation practice, as compared to the 2 1/2 minutes provided in the experiment. Such a possibility cannot be excluded, but from a purely practical standpoint, an imitation procedure which required as much as ten minutes of practice for a single phoneme would probably not be well received by the typical foreign language student. Many of the speakers in the present experiment stated informally that the imitation sequence had seemed quite long; to extend the session much beyond the length actually used might have adverse psychological effects.

A more interesting and probably more effective approach would seem to be the introduction, on a controlled basis, of other types of pronunciation assistance to supplement the imitation practice. Judicious use of short programs of discrimination training and/or the initial teaching of simple pronunciation "tricks" might show a considerable improvement in sound imitation over the results obtained under the very simple conditions of this experiment.

Some mention should also be made of the age of the American speakers with respect to the probable effect of this factor on imitative performance. It is generally considered, on the basis of observations made by foreign language teachers and others, that children of elementary school age or below exhibit appreciably greater facility in

imitating foreign language sounds than do older children or adults. Carroll (1960) cites a number of reports to this effect, and similar observations may be found in Andersson (1960) and Gatenby (1955). The studies by Penfield and Roberts (1959) suggest the loss of cerebral "plasticity" through chronological development as a possible neurological correlate for this decrease in imitative ability.

The age at which imitative facility would be reduced has not been closely determined, although the early teens has been suggested. Gatenby (1955) identifies "babyhood to ten plus" as a period during which the imitation of novel sounds is greatly facilitated; Andersson (1960) suggests age ten as the approximate time at which imitative ability is reduced and the learning of accurate pronunciation becomes more difficult.

If a turning point for pronunciation facility does occur at about this age, then the American speakers used in this experiment would represent a group for which some reduction in imitative ability might be expected. A replication of the experiment with a younger group of speakers (aged seven or eight, for example) might show considerably more positive results under the same conditions of administration. Nonetheless, it remains useful from a practical standpoint to study the imitative performance of high school age students and to attempt to find ways in which accurate pronunciation can be trained at this level.

Chapter 4

Individual Differences in Sound Judging Performance

Preliminary Discussion

As outlined in the Introduction, Experiments IV and V involved a rescoring of all of the French - American Imitation sound triplets by a group of native French listeners who were also familiar with English (Experiment IV) and by a group of American teachers of French who had learned French as a second language (Experiment V).

With respect to the probable judging performance of the French judges having a good knowledge of English, it was not known whether this additional linguistic experience would facilitate, hinder, or have a neutral effect on sound judging performance. This question is of practical interest in view of the fact that most native speakers of French teaching French in American school systems could be anticipated to have a rather extensive acquaintance with English, both in written and spoken form. If exposure to English were to decrease native French teachers' ability to discriminate certain mispronunciations by American speakers, these teachers might accordingly be less critical of such mispronunciations than would indigenous French speakers. In other words, these "French-English" teachers might accept as correct sounds which indigenous French speakers would find faulty. If no difference in judging ability were found between the two groups, then the French-English teachers could be considered as suitable substitutes for an indigenous criterion group. If the French-English teachers surpassed

the criterion group in discriminative ability, this would also be a pedagogically favorable outcome, on the assumption that no harm would be done by having a somewhat stricter classroom standard of acceptability than would be met in the real-life situation.[1]

The same consideration would apply in the case of American teachers of French. It would be desirable to have these teachers equal or surpass the sound judging performance of indigenous French listeners in order to certify their ability to perceive unacceptable pronunciations by students. Although it might eventually be possible to teach accurate foreign language pronunciation without having to rely on the teacher to judge the acceptability of student productions and to assist the student in his pronunciation attempts, the present situation suggests that a high level of discriminative ability (together with skill in pronunciation coaching) should still be an important component of the teacher's instructional repertoire.

Since the experimental procedures for Experiments IV and V were essentially similar, both will be described in the following section. Results for the two experiments will also be presented together, and will be compared to the criterion judging data of Experiment III.

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[1]This contradicts to some extent the cautions against "overteaching" made earlier, and from a strict point of view, the most suitable situation would be for the teacher to parallel the indigenous listener exactly. Nonetheless, superior discriminative ability on the part of the teacher would certainly be preferred to inferior performance in this respect.

Procedure

The sound judging sessions for Experiments IV and V were conducted in a manner similar to that for the Experiment III judging sessions and used the same stimulus materials and presentation equipment. The "French-English" judges met separately from the American teachers, and in both cases the judging of the French - American Imitation triplets required two meetings of about three hours each. The judges for each group were seated around a Tandberg 74 tape recorder set up in a quiet room, and the stimulus materials were played through the loudspeakers of the recorder. The taps recorded judging instructions (Appendix J) were the same as those used in Experiment III, as were the Portapunch cards used by the judges to record their responses (Appendix I).

The French-English judging group consisted of 12 native speakers of French, three men and nine women, who were living in the Cambridge, Massachusetts area. The judges' ages ranged from 17 to 47, with a mean of 28.0 and standard deviation of 9.7. All of the judges were by self report free of speech or hearing problems.

In contrast to the indigenous French judges used in Experiment III, the French judges for Experiment IV had an extensive background in English: this fact was clearly indicated by their responses to a detailed questionnaire (Appendix H). The total value of the coded responses to the first four questionnaire items (which measured extracurricular exposure to English in France) was 54 for the Experiment III group and 80 for the Experiment IV group (coding was positive for increasing exposure). The total number of English courses taken in the lycée also

differed appreciably in the two cases (35 for the indigenous French group and 66 for the French-English group).

By far the most important difference between the two groups in the extent of their exposure to English is considered to be the amount of time spent in travel or residence in English speaking countries. Only one member of the indigenous judging group had ever been in an English speaking country (for a two-week visit to England); the French-English judges, on the other hand, had been in English speaking countries, principally the United States, for periods of about 5 months up to 24 years, with an average stay of 6.2 years. Five of the judges reported travel to the United States only; three had also visited England for a month or less (as compared to 3, 4, and 24 years of residence in the United States). One judge had lived in England for 10 years before coming to the United States, where he had resided for 2 years; other combinations were: England, 3 months, U. S., 3 months; England, 4 months, U. S., 2 months; Scotland, 3 months, U. S., 2 months. In all cases, of course, the most recent residence had been in the United States.

A further indication of the English proficiency of the French-English judges was provided by scores on the Carroll-Ho Pictorial Auditory Comprehension Test in English (Form C), which was administered to the judges following the final sound judging session. This test presents, for each item, a panel of four pictures and a tape recorded English sentence which correctly describes one of the four pictures. The spoken sentences vary in difficulty from short, straightforward sentences embodying simple vocabulary ("That is father's chair") to

considerably longer and more complex statements involving more difficult lexical items ("The streets must be kept clean not only because of esthetic, but also because of hygienic reasons.")

Two of the Experiment IV judges obtained the maximum score of 75 on this test, and nine other judges scored 70 or above. Although a somewhat lower score of 63 was obtained by one judge (who had been in the United States for approximately 10 months), the average test score for this group was at the quite high value of 72.2.

The American teachers of French who made up the judging group for Experiment V were all native speakers of American English. The group consisted of three men and nine women, ranging in age from 23 to 45, with a mean age of 30.5 and standard deviation of 6.7. All reported normal speech and hearing.

Responses to a background questionnaire (Appendix M) indicated that these judges had varying degrees of experience in teaching French. Two had been teaching for only one year, and two others reported two years of experience. At the other extreme, two judges had 10 and 16 years of teaching experience; the remainder had been teaching from 3 to 5 years. The average number of years of instruction was 4.8.

All of the judges had studied French at the college level and eight reported one or more graduate level courses in French; in two of these cases, a master's degree in French had been received. Five of the 12 judges had attended NDEA French institutes.

The Listening Test section of the MLA Proficiency Tests for Teachers and Advanced Students (Form A) was given to 10 of the American

judges who had stayed after the final judging session for administration of the test. Raw scores obtained ranged from 23 to the maximum score of 36, with a mean of 31.4 and standard deviation of 4.9. This mean raw score corresponds to a percentile rank of 82.5 for a norming group of 7,418 French teachers who had taken this test at the completion of NDEA institutes held from 1961 to 1965. Percentile equivalents for the lowest and highest scores obtained by the Experiment V judges are 62.5 and 99.

Results and Discussion

As previously stated, the three groups of judges for Experiments III, IV, and V scored the same stimulus materials under comparable judging conditions. Thus, it was possible to evaluate differences in discriminative accuracy by a direct comparison of scoring performance for the three groups. To make this comparison, a one-way analysis of variance was conducted using the total sound identification score for each judge as a single observation within the appropriate group. The obtained results are shown in Table 15.

The observed differences in mean sound discrimination score for the three groups are not statistically significant ($p > .05$); thus, these results fail to show that the judging groups differed in discriminative ability, at least on an overall (across-sounds) basis. The probable reason for this outcome may be found by examining the discrimination scores for individual judges (Table 16), which show a rather wide range of performance among the members of each judging group.

To check the significance of these individual differences in judging

Table 15

Analysis of Variance of Sound Discrimination

Performance for Three Groups of Judges

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Groups	2	16,583	8291
Within	33	166,038	5031
Total	35	182,621	

For Groups $F_{(2, 33)} = 1.65$ n.s. ($p > .05$)

Table 16

Sound Discrimination Performance

of Individual Judges

Indigenous French (N = 12)	French-English (N = 12)	American Teachers (N = 12)
717 (58.6)	677 (55.3)	683 (55.8)
736 (60.1)	790 (64.5)	746 (60.9)
737 (60.2)	800 (65.4)	757 (61.8)
784 (64.1)	842 (68.8)	811 (66.3)
811 (66.3)	872 (71.2)	823 (67.2)
826 (67.5)	880 (71.9)	824 (67.3)
831 (67.9)	894 (73.0)	865 (70.7)
844 (69.0)	911 (74.4)	866 (70.8)
852 (69.6)	923 (75.4)	867 (70.8)
878 (71.7)	932 (76.1)	898 (73.4)
879 (71.8)	935 (76.4)	910 (74.3)
882 (72.1)	941 (76.9)	936 (76.5)
Mean 815 (66.6)	866 (70.8)	832 (68.0)
S.D. 61.4 (5.2)	81.8 (6.7)	77.5 (6.3)

Note.--Table entries show total correct identifications for each judge, arranged within each group by increasing accuracy. Maximum score = 1224 (34 sounds x 6 speakers x 6 imitations per speaker). Percentages are shown in parentheses.

performance, two-way (sounds x judges) analyses of variance were performed for each of the three groups. Cell entries were the total discrimination score for the sound and judge in question. Maximum cell score was 36 (6 speakers x 6 imitations per speaker). Results are shown in Tables 17-19.

A significant difference in sound judging ability was found among individual judges for each of the three groups, as well as anticipated significant differences among the sounds in ease of discrimination.

One implication of these results appear to be that individual differences in sound judging ability, rather than membership in a particular category of judges (indigenous French; French with knowledge of English; American teachers of French) are a more important source of variation in sound judging tasks of the type represented in this study. Although such a finding is reassuring in that it lends some confidence to an assumption of comparability in judging performance for groups of judges drawn from these three categories, it is disquieting in its implication that the judging performance of individual members of these groups might be expected to vary appreciably. Since it would usually be impractical to convene panels of judges for such purposes as scoring classroom tests of pronunciation, or for auditing language laboratory practice, some common and presumably rather high level of sound judging ability would be sought for each individual teacher. One suggestion in this respect would be the development and use of a "qualifying" test of sound judging performance, possibly along the lines of the discrimination tasks involved in the present experiments. Persons obtaining

Table 17

Analysis of Variance for Sounds and Judges

Indigenous French Group

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Sounds	33	185.95	5.63
Judges	11	31.08	2.82
Interaction	363	102.53	.282
Within	11,832	2949.42	.249
Total	12,239	3268.98	

For Sounds	$F_{(33, 363)}$	= 19.9	$p < .01$
For Judges	$F_{(11, 11,832)}$	= 11.3	$p < .01$
For Interaction	$F_{(363, 11,832)}$	= 1.1	n.s. ($p > .05$)

Table 18

Analysis of Variance for Sounds and Judges

French-English Group

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Sounds	33	154.70	4.69
Judges	11	55.11	5.01
Interaction	363	90.51	.249
Within	11,832	2737.08	.231
Total	12,239	3037.40	

For Sounds	$F_{(33, 363)}$	= 18.8	$p < .01$
For Judges	$F_{(11, 11,832)}$	= 21.6	$p < .01$
For Interaction	$F_{(363, 11,832)}$	= 1.08	n.s. ($p > .05$)

Table 19

Analysis of Variance for Sounds and Judges

American Teachers Group

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square
Sounds	33	182.02	5.52
Judges	11	49.46	4.50
Interaction	363	109.08	.333
Within	11,832	2856.22	.241
Total	12,239	3196.78	

For Sounds	$F_{(33, 363)}$	= 16.6	$p < .01$
For Judges	$F_{(11, 11832)}$	= 20.5	$p < .01$
For Interaction	$F_{(363, 11,832)}$	= 1.38	$p < .01$

low discrimination scores might profitably undertake a program of discrimination training, while those whose competence was initially high could be considered capable of judging student productions with an acceptable degree of accuracy. It might also be pointed out that the ABX sound presentation technique could also be adapted for instructional purposes by deliberately identifying the "not French" sound either before or after the triplet was pronounced: these identifications could also be accompanied by appropriate recorded comments.

Although a significant among-group difference in sound judging ability was not found for the French sounds taken as a whole, the question could still be raised as to whether certain individual phonemes were more accurately judged by a particular judging group. To examine this possibility, separate one-way analyses of variance were conducted for each of the 34 sounds involved. For each analysis, the three different judging groups were the categories of interest; within each category, the total correct identifications of that phoneme by a single judge were entered as separate observations.

A significant difference ($p < .05$) in mean identification scores among the three groups of judges was found for 8 vowels and 6 consonants or semiconsonants (Table 20). For each of these phonemes, the Scheffé procedure for comparing the significance between pairs of means (or paired groups of means) was employed; results of this analysis are also shown in Table 20.

In analyzing the observed results, it is necessary to keep closely in mind the actual nature of the American speakers' responses to the

Table 20

Between-Group Differences for Individual Phonemes

		Mean Discrimination Scores				Between-Group Differences									
		Indigenous French Judges (A)	French Judges with Background in English (B)	American Teachers of French (C)	Overall Significance Level[a]	A>B	B>A	A>C	C>A	B>C	C>B	A<B>C	C>A<B	A>B<C	B<C>A
Vowels	/i /	27.25	26.75	22.00	**			*		*		**			
	/ə /	23.08	24.75	19.08	**			*		**		**			
	/œ/	25.83	28.42	23.67	**					**					
	/a /	26.00	26.33	21.42	**			**		**		**			
	/ɛ /	16.33	18.75	19.75	*				*						*
	/o /	25.08	26.75	29.08	*				*						
	/y /	26.58	29.50	30.58	**		*		**				*		**
	/õ /	25.50	30.25	28.67	*		*								*
Consonants	/g /	24.83	25.42	29.83	**				**		**		**		
	/m /	25.50	25.58	22.00	*					*		*			
	/ʒ /	27.00	26.58	22.75	**			**		*		**			
	/j /	14.83	20.17	18.58	**		**		*						**
	/R /	23.25	25.83	26.25	*										*
	/ɥ /	23.33	30.42	25.25	**					**					**

Notes.--Nonsignificant among-group differences ($p > .05$) were found for the remaining vowels and consonants: (/ã /, /œ̃ /, /ɛ̃ /, /e /, /u /, /ɔ /, /ø /; /d /, /l /, /p /, /f /, /b /, /w /, /n /, /t /, /v /, /s /, /z /, /k /, /ʏ /.)

[a]Significance levels indicated by: * = $p < .05$; ** = $p < .01$

sounds in question and, particularly, the extent of variation present in these responses. When, for a given phoneme, a uniform pronunciation was generally adopted by the American speakers, the linguistic differences between the French decoy sounds and the pronounciations given by the American speakers could be described fairly easily, as could the discrimination tasks which these differences would have presented to the judges. On the other hand, when the American speakers' responses to a particular phoneme varied widely, as was often the case, it would be virtually impossible to estimate the discrimination features operating in that situation or to suggest the basis on which observed differences in judging performance among the three groups could have arisen.

For this reason, the experimenter feels that no meaningful analysis of inter-group differences in discrimination scores can be made for the following phonemes: /o /, /y /, /ɔ̃ /, /ɛ̃ /, /R /, and /ɥ /. The reader is referred to the verbal descriptions of the American speakers' responses to these sounds[1] as an indication of the highly varied pronunciations given. In addition to these sounds, the observed results for two other phonemes, /ə/ and /œ/, have been suggested to be somewhat equivocal in view of the artificiality of the single-sound context in which they appeared in this experiment.

The remaining sounds for which significant among-group differences in judging performance were found are the vowels /i /, /a /, and /ɛ /, and the consonants /m /, /ʒ /, and /j /.

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[1] (pp. 150-164)

The American speakers' imitations of /i / were found to have been discriminated more accurately by the two groups of French judges than by the American teachers. A possible hypothesis here is that the diphthongization and/or generally lower timbre of the American speakers' imitations was more apparent to the French listeners than to the American judges. However, little support for an across-sounds generalization of such a conclusion can be shown: a second vowel which was consistently mispronounced in the same manner (/e /) showed no significant differences in discrimination level among the three groups.

The French and French-English judging groups also discriminated the imitated /a / more accurately than did the American teachers. This is interesting in that the (American) experimenter had found no appreciable difference between most of the American imitations of this sound and the French decoy sounds. On the other hand, in the somewhat similar discrimination situation for /ɛ / (where minor differences in timbre between the decoy sounds and the American imitations would again be at issue), the American judges appeared superior to the indigenous French judges in discriminative ability.

Among the consonants, a significantly more accurate discrimination of the imitated /m / was found for the two French groups; however, the experimenter can suggest no linguistic basis for such an outcome, and suggests that this effect is more conveniently described as random.

Both groups of French judges were also more accurate in discriminating American speakers' imitations of /ʒ / than were the American teachers. A common error on the part of the speakers for this sound was

less forceful voicing of the consonant, a feature which may have been more distinctive to the native listeners than to the American teachers.

The superiority of the American teachers and the French-English group in discriminating the imitated /j / is not easily explained, and no hypothesis other than that of random effect is advanced.

In light of the significant individual differences in judging ability shown within all of the judging groups, it seemed useful to investigate a possible relationship between certain variables in the linguistic background of the judges (as given on the judges' questionnaires) and scund scoring performance. The most practical approach in analyzing the French judges' questionnaire (Appendix H) appeared to be the compilation of a single summary figure which would express both the extent and probable "quality" of the judges' exposure to English.

The procedure used to determine this overall English exposure score was to code positively responses indicating more extensive and/or more direct contact with English, particularly in spoken form. For example, for the first question, "En France, avez-vous été exposé à de l'anglais parlé en dehors de classe?," a score of 1 was assigned to the response "non, ou presque pas"; 2 was assigned to "oui, un peu (des films, des disques, des programmes à la radio)"; and 3 to "oui, d'assez nombreux contacts avec des personnes parlant anglais." Similar coding was carried out for the next three questions on the first page. For the second and third pages, which concerned English courses taken at the lycée, an essentially similar procedure was followed: answers favorable to contact with English (large number of courses per week, relatively

small classes, frequent use of English by the teacher and students, accurate pronunciation by the teacher, student contact with répétiteurs) were all positively coded, with lower scores assigned to less favorable answers.

Coding for page four of the questionnaire (travel or residence in English speaking countries) consisted of summing the length of the sojourn(s) in weeks, weighted by the "quality" of the sojourn with respect to English contact (for example, residence in a private home was scored more highly than was stay in a hotel).

The "total questionnaire score," which represented the summation of all these items, was found to have a rather wide range: questionnaire scores for the indigenous French judges ranged from 4 to 105; for the French-English judges, this range was from 107 to 1345. For the French-English group, a simplified variable consisting only of the total number of weeks spent in English speaking countries was also identified; this variable ranged from 20 to 1277. Additional summary statistics for the questionnaire scores of these two groups are shown in Tables 21 and 22.

In processing the background questionnaire for the American teachers (Appendix M), three basic variables were identified: total number of years experience in teaching French, total number of French courses taken at the college level or beyond, and total number of weeks spent in a French speaking country. Since several American teachers reported additional experience at NDEA institutes, a fourth variable was specified which consisted of the total number of college or higher level French courses plus an arbitrary increment of 5 to represent the NDEA

Table 21

Background Variable Analysis for Indigenous French Judges

(Experiment III)

N = 12

	Age	Sex	Total Questionnaire Score	Sound Discrimination Score (Criterion)
Range	19-30	[6M, 6F]	4-105	717-882
Mean	23.67	--	41.75	815.33
Standard Deviation	3.11	--	44.51	55.52

Correlation Matrix[a]

		(1)	(2)	(3)	(4)
Age	(1)	1.00			
Sex	(2)	.11	1.00		
Total Questionnaire Score	(3)	-.03	.49	1.00	
Sound Discrimination Score	(4)	.30	-.10	.26	1.00

[a]All correlations with criterion are nonsignificant ($p > .05$). (Correlation for sex treated as $r_{p\text{-bis.}}$)

Table 22

Background Variable Analysis
for French Judges Familiar with English

(Experiment IV)

N = 12

	Age	Sex	Total Questionnaire Score	Weeks in English Speaking Country	Sound Discrimination Score (Criterion)
Range	17-47	[3M, 9F]	107-1345	20-1277	677-941
Mean	28.00	--	403.17	321.83	866.17
Standard Deviation	9.72	--	391.55	395.97	74.75

Correlation Matrix[a]

		(1)	(2)	(3)	(4)	(5)
Age	(1)	1.00				
Sex	(2)	.53	1.00			
Total Questionnaire Score	(3)	.79	.35	1.00		
Weeks in English Speaking Country	(4)	.80	.36	(.998)[b]	1.00	
Sound Discrimination Score	(5)	.00	.53	-.00	-.02	1.00

[a]All correlations with criterion are nonsignificant ($p > .05$). (Correlation for sex treated as $r_{p\text{-}bis.}$)

[b]Part-whole correlation.

Table 23

Background Variable Analysis
for American Teachers of French

(Experiment V)

N = 12

	Age	Sex	Years Teaching French	Total French Courses Taken	French Courses Plus Institute	Weeks in French Speaking Country	Sound Discrimination Score (Criterion)
Range	23-45	[3M,9F]	1-16	6-34	7-35	2-600	746-936
Mean	30.50	--	4.83	18.08	21.42	77.67	832.17
Standard Deviation	6.67	--	4.01	9.62	10.00	161.64	71.02

Correlation Matrix[a]

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age	(1)	1.00						
Sex	(2)	-.42	1.00					
Years Teaching French	(3)	.63	-.02	1.00				
Total French Courses Taken	(4)	-.13	.40	.04	1.00			
French Courses Plus Institute	(5)	.03	.39	.31	(.93[b])	1.00		
Weeks in French Speaking Country	(6)	.71	-.45	.35	-.29	-.26	1.00	
Sound Discrimination Score	(7)	.29	.05	.27	.04	-.01	.20	1.00

[a]All correlations with criterion are nonsignificant ($p > .05$). (Correlation for sex treated as $r_{p\text{-}bis.}$)

[b]Part-whole correlation.

experience. Summary statistics for these variables are shown in Table 23.

Sex (coded 1-2) and age in years were also entered for all three groups.

Results of the correlational analyses (conducted separately for each group) fail to show a significant correlation between any of the background variables and the criterion measure of sound discrimination performance. It may be suggested that the small number of cases involved made it difficult to obtain a statistically significant result, and that with an appreciably larger number of cases a reliable correlation might be obtained between one or more of the predictor variables and sound discrimination performance. The practical value of such a finding would, however, be limited, since even the discovery of correlational trends based on large numbers of cases would be of little use in deciding whether or not a particular teacher or test scorer could be considered qualified in sound judging tasks of the type under study. A more direct and possibly more successful approach to determining sound judging accuracy would be to make use of a work-sample test which would incorporate representative discrimination tasks in a format similar to that used in the study.

Conclusion

Although results of each of the experiments conducted under this study have been discussed in detail in individual chapters of the report, it would be useful at this point to summarize briefly the purpose and general outcome of each experiment and to review the implications which the obtained results might have for the teaching of French pronunciation in the school situation.

Experiment I investigated the extent to which each of 38 English phonemes could be expected to serve as phonemically acceptable counterparts for French sounds. The basic pedagogical consideration underlying this experiment was the assumption that greater overall economy of instruction could be obtained by excluding from formal consideration (at a phonemic level of competence) any French sounds for which already-available English sounds were found to serve as acceptable phonemic counterparts. Objective data on the phonemic-level reception of English sounds in French would be of value both for training programs which consider a phonemic command of the language to be an appropriate terminal level and for those which consider phonemic command as an intermediate stage to be followed by instruction in phonetically accurate pronunciation.[1]

In Experiment I, each of the English sounds tested (Appendix B) was examined under a judging system in which native speakers of French gave example French words embodying the "same" sounds as those heard or

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[1] For discussion, see Introduction, pp. 4-11.

indicated that they were unable to find such sounds in the French phoneme set. Obtained results showed, first of all, that several English sounds could in fact be considered highly acceptable in French at the phonemic level. Among the vowels, for example, the English /a / and /i / were almost exclusively paired with the appropriate French counterpart, and /u / and /o / were also frequently identified with their respective French sounds.[1]

Many of the English consonants were similarly found to exhibit a high level of phonemic congruence with their French counterparts: English /ʃ /, /ʒ /, /s /, /m /, /n /, /l /, /p /, /t /, /k /, /f /, /v /, and /z / all evoked the appropriate French consonant with high frequency, and the two semiconsonants /j / and /w / were also paired almost exclusively with the expected French counterparts. In all of these cases, the assumption may be made that student production of the English sounds would be heard by native French listeners as comprehensible (although possibly non-native) renditions of the appropriate French sounds. At least on a phonemic level of competence, it would thus not be necessary to teach the pronunciation of the sounds in question, since the student's own English pronunciations would in themselves be comprehensible to French auditors.

On the other hand, a number of English sounds were found to be ambiguously received by the French listeners in the sense that they

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[1]For a detailed description of judging responses to the English sounds, see pp. 47-61.

assigned more than one French phoneme to a given English stimulus. Responses to English /I /, for example, were uniformly spread among /i_f /, /e_f /, and /ε_f/, suggesting that considerable phonemic ambiguity would accompany use of this sound in French. In view of the tendency of American speakers to lower the high French /i /, particularly in unstressed position, there is considerable potential for student production of /I / in French speech situations. Although contextual clues might help to resolve /I /-produced (or other) ambiguities, it would appear safer from a pedagogical standpoint not to rely on the presence of such clues but rather to eliminate the possibility of such ambiguity by correcting the pronunciation in question.

A number of English consonants also demonstrated phonemic ambiguity: /d̂ /, for example, was variously interpreted as representing each of nine different French consonants. In this particular case, however, the American student would not be likely to pronounce the sound in French speech situations,[1] and no real pedagogical problem would be suggested.

An interesting ambiguity was observed for English /b /, /d /, and /g /, which were misheard with considerable frequency as /p /, /t /, and /k /--that is, as the unvoiced analogs of the consonants in question. On the assumption that some defect (from the French standpoint) in the voicing of these sounds was responsible for the observed perceptual

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[1] (except possibly inadvertently or through lexical influence in reading)

shift, it may be appropriate to train the American student to produce an earlier and more forceful voicing of /b /, /d /, and /g / when attempting to use these sounds at the French phonemic level.

The experimental data also showed a third category of English sounds --those which the native French judges consistently rejected outright as having no counterpart in the French phonemic system. The English diphthongs /au /, /ɔi /, /ju /, and / ɑi /, for example, were all rejected with high frequency as not equivalent to any single French sound (although some judges did identify French words in which these sounds appear as two separate phonemes). Of these sounds, /au /, /ɔi /, and / ɑi / would probably not occur with any appreciable frequency in the French speech of the American student: English /ju /, on the other hand, is a common student substitute for /y_f /; on the basis of the experimental results, this substitution would appear to be invalid even at the phonemic level, and early attention to the production of a phonemically acceptable /y_f / would thus be indicated.

Among the consonants, English /dʒ / and /tʃ / were uniformly rejected as not corresponding to any French phoneme. Student use of these sounds in French would not, however, be anticipated, except under English orthographic influence in a reading aloud situation or, rarely, in the deliberate speech of a visually oriented student thinking in terms of English orthography.

Experiment I results also supported the usual working assumption that certain French sounds are entirely foreign to the English phoneme set (see for example Politzer, 1965, p. 97). French /y / was never

selected by the French judges in response to any of the English sounds presented, nor was /ɥ/. Similarly, the four nasal vowels, /ɛ̃/, /ɑ̃/, /ɔ̃/, and /œ̃/ were only very infrequently and apparently sporadically paired with English vowels, again suggesting that there are no reasonable English equivalents for these sounds. These results of course imply that an acceptable pronunciation of each of these sounds would have to be deliberately taught to American students.

Experiment II was conceptually related to Experiment I in that it also tested the acceptability of English sounds in French. The criterion of acceptability in Experiment II was, however, no longer one of simple comprehensibility but rather one of phonetic indistinguishableness from the corresponding French sounds, as judged by native French listeners.

In determining the sounds to be tested in Experiment II, English sounds found in Experiment I to be unacceptable in French at the phonemic level were automatically excluded from consideration on the grounds that an English sound which did not have even a valid phonemic identity in French would certainly prove unacceptable at the more demanding level of phonetic equivalence. Eight English vowels and 16 consonants (Appendix F) were selected for inclusion in Experiment II and were tested under an ABX judging procedure discussed in detail in Chapter 2.[1] For each of the ABX triplets--consisting of one English sound and two French "decoy" sounds--the judges attempted to determine which of the three sounds was "not French."

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[1](see pp. 73-78)

Results of an initial experiment (IIA) were considered generally unsatisfactory, particularly in the case of the consonants, for which the judges' discrimination of the carrier vowel /i / was felt to have raised identification scores to an unrealistically high level and to have attenuated presumed differences in identification scores among the consonants. In addition, identification levels for both vowels and consonants were probably also raised to some extent through a disparity in the ages of the French and English speakers which produced somewhat differing vocal characteristics for the two groups taken as a whole.

A replication of this experiment (IIB) was conducted using a new group of American speakers more closely comparable in age to the French decoy speakers; some instruction in the production of a high, non-diphthongized carrier vowel was also given before the new speakers pronounced the English consonants. Results of this experiment[1] showed somewhat lower mean identification levels for both vowels and consonants, although the consonant scores were still considered inappropriately high, at least for some sounds such as /m /, /n /, /v /, /z /, which are closely comparable to French sounds from an articulatory standpoint and would accordingly be presumed to be highly similar on an acoustic basis.

Experimental results for the vowels were considered more valid; among the vowels, the most notable finding was the low rejection (i.e., high acceptance) level for English /a /, both in absolute terms and

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[1](statements in the following paragraphs refer to IIB data)

by comparison to the other vowels tested.[1] A "bootstrap" implication of this finding would be that in any further replications of this experiment (or in other experiments requiring use of a carrier vowel), /a / should be adopted as the English vowel least likely to be discriminated by French judges. From a pedagogical standpoint, the high acceptability of /a_e / at the French phonetic level would imply that attempts to improve student production of this sound might safely be postponed until other more serious problems had been addressed.

Less salient differences in discrimination level were observed among the other vowels; however, their general location on the discrimination scale, when considered in conjunction with the relative frequency of occurrence of these sounds in spoken French, would suggest certain instructional priorities. English /e / was the vowel most easily discriminated at the phonetic level, and further, a frequency tabulation presented by Delattre[2] lists /e_f / as the most frequently occurring vowel phoneme. On this basis, attention to the correct pronunciation of /e_f / would be indicated as an early undertaking in any teaching programs which adopt a criterion of phonetic mastery of the French sounds.

English /o / and /u / were also easily discriminated as "not French" by the French judges; however, an appreciably lower frequency

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[1]Total discrimination percentage for /a_e / was 50.0, with a chance response level of 33.3 percent. The next most acceptable vowel, /i_e /, was discriminated with 71.1 percent accuracy.

[2](see Chapter 2, p. 106)

of occurrence for both of these sounds would suggest, at least on a statistical basis, that their correction would be of somewhat less immediate importance.

French /i / and /ɛ / were found to occupy an intermediate position on the discrimination scale; the greater frequency of occurrence of /i / (in a ratio of about 2 to 1) could be considered to give additional significance to the teaching of this sound.

Interpretation of the consonant discrimination data, both statistically and visually, is difficult in view of the restricted range of identification scores obtained. English /w / was found to be significantly less frequently discriminated than any of the other consonants, but the other significant differences obtained indicated only that certain English sounds at one end of the discrimination scale (/j /, /ʃ /) were more acceptable than a few sounds (/p /, /s /, /l /) at the other extreme. The majority of consonants did not differ reliably from one another in discrimination level, and the observed sequencing in a major portion of the scale was thus considered essentially random. A further replication of this experiment using /a / as the carrier vowel would be expected to provide a greater range of consonant discrimination scores and to permit finer comparisons among the English consonants with respect to their phonetic acceptability in French.

Economy of instruction implies not only that the curriculum designer (or classroom teacher) should exclude from formal consideration any behaviors which are already available in criterion form but also that he should specify straightforward and easily implemented procedures for

teaching those behaviors which must be learned. With respect to the training of accurate sound production at the phonetic level, a process of student self-instruction involving only the repeated imitation of target language sounds was considered among the simplest possible procedures: such a procedure does not require the presence of a teacher, nor does it involve the use of elaborate instructional materials or presentation techniques. In designing the pronunciation training phase of the study (Experiment III), the assumption was made that any French sounds which could be learned to a criterion of phonetic acceptability through such a self-shaping process would not require (or indeed, merit) the use of more complicated procedures; on the other hand, sounds which could not be learned acceptably through simple imitation could be considered proper objects of more complex teaching programs.

Since the sound judging results for Experiment II had suggested that none of the English sounds tested were completely acceptable at the French phonetic level, it was assumed that all of the French sounds would require some training at the phonetic level, and as such, should be included in Experiment III.[1]

In this experiment, model presentations of 34 French phonemes (Appendix K) were played through activated earphones[2] to American high

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[1]As previously mentioned, the phonetic acceptability of some of the English consonants may have been masked by the judges' discrimination of the carrier vowel; nonetheless, all of these consonants were included in Experiment III on a "fail-safe" basis.

[2]See p. 113 for a discussion of the necessity to adopt this slightly more complex form of instrumentation.

school students with no prior study of French; each phoneme was imitated for about 2 1/2 minutes (a total of 36 repetitions) by each of six students. Samplings of the student imitations were taken at the beginning, middle, and end of the imitation sequences, and the imitations were subsequently judged by native French listeners under an ABX procedure similar to that used in Experiment II.

The statistical results of this experiment are of some interest: although highly significant differences in sound discrimination scores were observed for both vowels and consonants--suggesting that some of the French phonemes had been pronounced more successfully than others--no significant improvement in sound production was found over the three sampling intervals. In an attempt to explain this phenomenon, the experimenter relistened to the imitation sequences of each of the American speakers; on this basis, it was determined that certain French sounds, such as /a /, /ɛ /, and the consonants /n /, /m /, /s /, /z /, and /v /, had been quite accurately produced from the beginning of the imitation sequence, while others (see below for examples) had not been successfully imitated at any point in the training sequence.[1]

A number of different factors seemed to be involved in these insuccesses: persistent diphthongization was observed for several vowels (/i /, /e /, /o /, /u /); laxness of production and a general tendency to lower the timbre of the sound were also noted (/i /, /ø /). The French nasals /ɛ̃ /, /ɑ̃ /, /œ̃ /, and /ɔ̃ / all proved difficult: several of the speakers imitating these sounds never acquired the technique of nasalization and gave instead entirely oral responses; others

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[1]Detailed response protocols for all sounds are given on pp. 150-164.

readily produced nasalized sounds but experienced great difficulty in assigning the correct timbre to the imitated sound. The French /y /, which was found in Experiment I to be a phonemically novel sound, proved highly resistant to acceptable imitation by the untrained American students; most of the imitations approximated /I / or /ø /, and the correct sound was never approached.

Among the consonants, /p /, /t /, and /k / were usually highly aspirated, and in addition there was some apparent difficulty in discriminating French /k /, which several students initially pronounced as /t / or /d /; a similar problem was observed for /g /.

The French /R /, as would be expected, posed great problems for the American speakers. Some discriminative confusion with /z / was noted, but the most significant problem was persistent inability even to approximate the correct articulation.

The basic conclusion which may be drawn from these "unsuccessful" response protocols is that some type of additional instruction in the production of these sounds is strongly indicated. The form which such instruction might take can be only generally indicated here: preliminary sound discrimination training (which was deliberately omitted in the present study on the grounds that it constituted an additional and possibly unnecessary procedure) would probably be of value, at least for sounds which were incorrectly discriminated by the American students. In this connection, the erroneous responses given by the speakers in this experiment might be a useful indication of some of the alternative sounds against which the discrimination training should be conducted.

For sounds which were seen to share a common pronunciation fault (e.g., diphthongization of /i /, /e /, /o /, /u /; aspiration of /p /, /t /, /k /; non-nasality of /ɛ̃ /, /ɑ̃ /, /œ̃ /, /ɔ̃ /), some type of general instruction for the feature in question might be developed which would improve the pronunciation of all of the sounds in that group.

With respect to efficient research procedures, a useful suggestion may be to maintain a standardized sound imitation task similar to that used in the present study and to supplement it with various short training programs which would be administered prior to the imitation practice. Responses would be sampled and judged in a manner similar to the present procedure (or incorporating certain changes such as the use of a larger number of speakers per sound and the more extensive sampling of responses for a given speaker). Since the ABX judging procedure is considered a "high-powered" measurement technique (see discussion, p. 166-167), its use would probably be found appropriate even at rather high levels of student performance.

The final project experiments (Experiments IV and V) compared the sound judging performance of indigenous native speakers of French (the Experiment III judges) to that of two other groups of judges: French natives with appreciable exposure to English and American teachers of French for whom French was a second language. Since the ability of the classroom teacher to judge the acceptability of student-produced sounds may be considered an important factor in successful pronunciation teaching (at least in the present-day absence of automated pronunciation

training procedures), it would be important to establish whether or not American-born teachers of the language (or native speakers who have been extensively exposed to English) would in general be able to judge these sounds at least as accurately as a criterion group of indigenous native speakers.

In this experiment, each of the two new groups of judges rescored the American imitation - French decoy triplets which had previously been judged by indigenous French judges in Experiment III. The judging results for these three groups were statistically compared, and no significant differences in judging accuracy were found for the three groups on an across-sounds basis. A limited number of significant among-group differences were found for the judging of individual sounds, but these results were considered to be an essentially random effect.

In contrast, highly significant differences in judging ability were found among individual judges for each of the three groups; these results suggested that individual variation in judging ability, rather than membership in a particular linguistic group, was the major source of variation in judging performance.

Questionnaire data relating to the French judges' exposure to English and the American teachers' background in French failed to correlate significantly with judging performance, and sex and age of the judges were also uncorrelated with sound discrimination scores. A tentative suggestion for the design of a predictive test of sound judging ability would be to make use of work-sample items dealing with

the actual discrimination of French and non-French sounds. In this regard, a selected subset of ABX triplets from the present study might usefully be employed.

Appendix A

Experiment I

Background Questionnaire for English Speakers

PLEASE PRINT

NAME_____ CLASS (junior, grad., etc.)_____
first initial last

LOCAL ADDRESS_____ PHONE_____

DATE OF BIRTH_____ PLACE OF BIRTH_____
mo. day year town, city state

PLEASE LIST BELOW in chronological order all of the American towns or cities in which you have lived <u>for a year or more</u> from birth up to the present time. Please also give the approximate number of years in each case. Begin with your birthplace.

	<u>City, Town</u>	<u>State</u>	<u>Years of Residence</u>
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			

HAVE YOU LIVED IN OR VISITED ANY FOREIGN COUNTRIES for a period of <u>one month or more</u> (per country)? If so, please fill out the table below:

	<u>Name of Country</u>	<u>Year(s) of Visit</u> (ex. 1959-1960)	<u>Approx. Duration (months)</u> (ex. 14 mos.)
1)			
2)			
3)			
4)			
5)			

MORE ON OTHER SIDE OF PAGE

Appendix A (continued)

WHAT MODERN FOREIGN LANGUAGES HAVE YOU STUDIED IN SCHOOL, from grade school to the present time? Please list each language studied, giving the approximate number of semesters of study in each case.

ARE YOU AWARE OF ANY SPEECH OR HEARING PROBLEM, no matter how slight? If so, please give details below:

Signature_____

Appendix B

English Sound Lists for Experiment I

List 1

/a /	a	:	father
/ə /	u	:	upper
/ɔ /	a	:	saw
/ju/	you	:	youth
/e /	ay	:	bay
/au/	ou	:	mouse
/ɔi/	oi	:	boil
/U /	oo	:	good
/ɛ /	e	:	bet
/i /	ee	:	feel
/u /	oo	:	pool
/ai/	i	:	fight
/I /	i	:	lid
/æ/	a	:	man
/o /	ow	:	throw
/b /	b	:	bulb
/m /	m	:	must
/r /	r	:	run
/ð /	th	:	thus
/v /	v	:	Vulcan
/j /	y	:	young
/l /	l	:	love
/k /	c	:	come
/n /	n	:	numb
/ʃ /	sh	:	shun
/θ /	th	:	thumb
/h /	h	:	hum
/t /	t	:	tummy
/z /	z	:	Zundapp
/ʒ /	ge	:	beige
/f /	f	:	fun
/dʒ/	j	:	judge
/p /	p	:	pun
/tʃ/	ch	:	chum
/g /	g	:	gum
/d /	d	:	dud
/w /	w	:	wonder
/s /	s	:	gun

List 2

/I /	i	:	if
/ə /	u	:	under
/i /	ea	:	reach
/u /	o	:	move
/e /	ai	:	aim
/U /	u	:	pull
/ɔ /	aw	:	law
/ɔi/	oy	:	boy
/o /	o	:	owe
/ai/	i	:	nice
/au/	ou	:	sound
/u /	u	:	Utah
/a /	a	:	ah
/ɛ /	e	:	set
/æ/	a	:	bat
/h /	h	:	hum
/ɵ /	th	:	thumb
/d /	d	:	dud
/ʃ /	sh	:	shun
/z /	z	:	Zundapp
/l /	l	:	love
/j /	y	:	young
/m /	m	:	must
/ʒ /	ge	:	beige
/s /	s	:	sun
/f /	f	:	fun
/p /	p	:	pun
/dʒ/	j	:	judge
/tʃ/	ch	:	chum
/n /	n	:	numb
/t /	t	:	tummy
/v /	v	:	Vulcan
/b /	b	:	bulb
/g /	g	:	gum
/k /	c	:	come
/r /	r	:	run
/w /	w	:	wonder
/ð /	th	:	thus

List 3

/o /	o	:	toe
/æ/	a	:	at
/i /	e	:	eat
/u /	oo	:	boot
/a /	o	:	common
/ju/	u	:	unite
/ɔi/	oy	:	toy
/ai/	i	:	pie
/U /	u	:	full
/ə /	u	:	custom
/ɔ /	aw	:	caw
/e /	a	:	ace
/au/	ow	:	now
/I /	i	:	fist
/ɛ /	e	:	pet
/s /	s	:	sun
/h /	h	:	hum
/ð /	th	:	thus
/m /	m	:	must
/k /	c	:	come
/p /	p	:	pun
/t /	t	:	tummy
/ʃ /	sh	:	shun
/z /	z	:	Zundapp
/n /	n	:	numb
/w /	w	:	wonder
/tʃ/	ch	:	chum
/g /	g	:	gum
/j /	y	:	young
/θ /	th	:	thumb
/b /	b	:	bulb
/ʒ /	ge	:	beige
/dʒ/	j	:	judge
/l /	l	:	love
/v /	v	:	Vulcan
/d /	d	:	dud
/r /	r	:	run
/f /	f	:	fun

List 4

/e /	a	:	ale
/i /	ee	:	see
/o /	o	:	go
/ɔ /	a	:	talk
/I /	i	:	it
/æ/	a	:	add
/U /	oo	:	foot
/ai/	i	:	write
/ə /	o	:	come
/u /	oo	:	moon
/ju/	u	:	use
/au/	ow	:	cow
/ɔi/	oy	:	coy
/a /	a	:	mama
/ɛ /	ea	:	deaf
/w /	w	:	wonder
/p /	p	:	pun
/l /	l	:	love
/z /	z	:	Zundapp
/h /	h	:	hum
/ʃ /	sh	:	shun
/m /	m	:	must
/tʃ/	ch	:	chum
/t /	t	:	tummy
/d /	d	:	dud
/k /	c	:	come
/dʒ/	j	:	judge
/θ /	th	:	thumb
/g /	g	:	gum
/f /	f	:	fun
/v /	v	:	Vulcan
/n /	n	:	numb
/r /	r	:	run
/s /	s	:	sun
/ð /	th	:	thus
/ʒ /	ge	:	beige
/b /	b	:	bulb
/j /	y	:	young

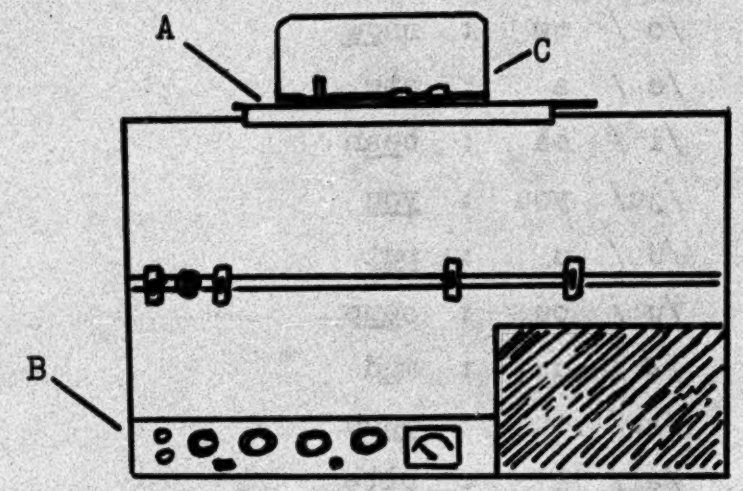
Appendix B (continued)

List 5

/æ/	a	:	last
/a /	a	:	watch
/ɔ /	aw	:	awe
/I /	i	:	is
/ɔi/	oi	:	toil
/ɛ /	e	:	met
/o /	ow	:	show
/e /	a	:	ate
/i /	ea	:	bean
/ju/	you	:	you
/U /	u	:	put
/u /	ou	:	soup
/ə /	u	:	mud
/aw/	ou	:	ouch
/ai/	i	:	bite
/k /	c	:	come
/s /	s	:	sun
/t /	t	:	tummy
/l /	l	:	love
/b /	b	:	bulb
/dʒ/	j	:	judge
/θ /	th	:	thumb
/r /	r	:	run
/d /	d	:	dud
/ʒ /	ge	:	beige
/v /	v	:	Vulcan
/h /	h	:	hum
/p /	p	:	pun
/ʃ /	sh	:	shun
/z /	z	:	Zundapp
/n /	n	:	numb
/tʃ/	ch	:	chum
/f /	f	:	fun
/ð /	th	:	thus
/g /	g	:	gum
/j /	y	:	young
/w /	w	:	wonder
/m /	m	:	must

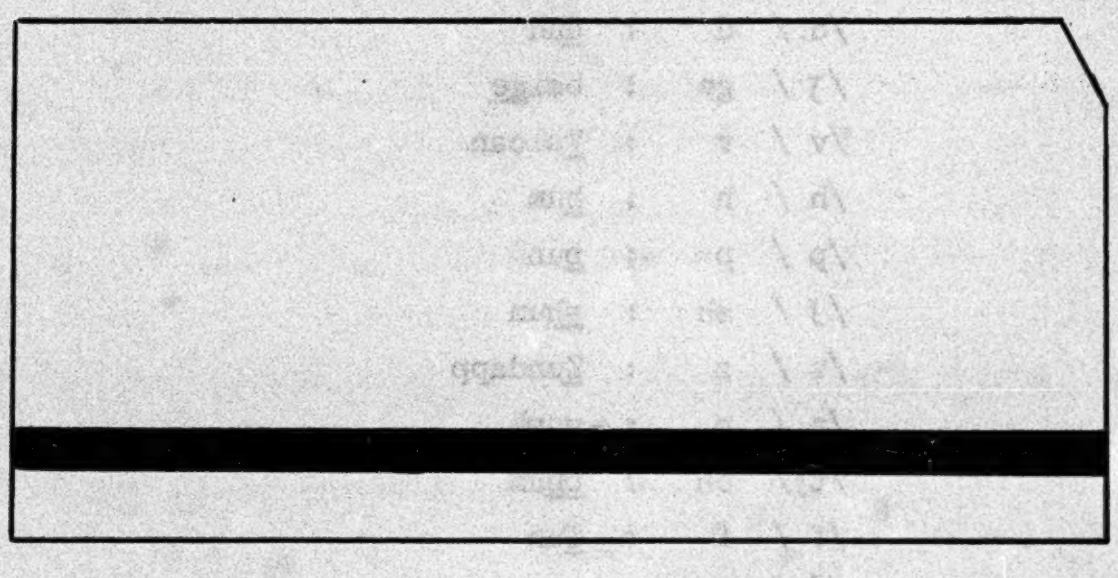
Appendix C

Laconic I Card Recorder



Major components include modified Viking cartridge tape deck (A) and Viking RP 83 recording and playback preamplifier (B). Card (C) shown in recording position. Speed through recorder is 3 3/4 ips; useful recording time approximately 2 seconds per card. Overall dimensions: 12"(h), 18"(w), 12"(d).

Recording Card



Recording card dimensions 3 1/4" x 7 5/8". Recording tape is glued to card with emulsion side out.

Appendix D

Judging Instructions for Experiment I

Bienvenue à cette expérience auditive. Au cours de cette expérience nous vous demanderons d'écouter un certain nombre de sons et de déterminer s'il existe des sons semblables en français. Pour chaque cas, s'il existe un son semblable en français, vous écrirez un mot bref contenant ce son sur la feuille de réponse qui vous a été distribuée. S'il n'existe pas de son semblable en français, vous écrirez qu'il n'y a pas d'équivalent.

Je vais vous expliquer en plus de détail les règles à suivre pour juger les sons. Vous voyez devant vous une feuille qui contient vingt lignes numérotées, sur lesquelles vous écrirez vos réponses aux vingt premiers sons présentés. Tous les cinq sons, je vous donnerai le numéro du son pour éviter les erreurs de numérotation au cours de l'expérience. Après chaque son on vous donnera le temps d'écrire votre réponse. Il n'est pas nécessaire d'écrire votre réponse en gros caractères, mais tâchez d'écrire de manière facilement lisible.

Pour chaque son, vous devrez écouter avec attention, et puis décider s'il existe un son semblable en français. Ne jugez pas les petits détails de prononciation, c'est à dire, ne vous demandez pas si le son est en fait prononcé par une personne de langue maternelle française, mais plutôt, tâchez de déterminer tout simplement s'il existe un son semblable en français dans le sens que vous pouvez penser à des mots français qui contiennent ce son. S'il y a des mots français qui contiennent ce son, vous devrez écrire un mot typique contenant ce son à l'endroit indiqué. Le mot peut être bref si vous le désirez, et peut être n'importe quel mot qui vous vient à l'esprit pourvu qu'il contienne le son que vous venez d'entendre. Si, à votre avis, le son n'existe pas en français, vous devriez écrire P.E. ("pas d'équivalent") pour indiquer qu'il n'y a pas de son équivalent en français, et que vous ne pouvez trouver aucun mot contenant ce son.

Appendix D (continued)

Je vous donnerai maintenant quelques exemples de démonstration. Ecoutez le son suivant (/o_e /). Vous avez peut-être remarqué que ce son n'était pas prononcé par une personne de langue maternelle française, mais en même temps le son est certainement compréhensible parce qu'il existe un son semblable en français dans des mots tels que <u>beau</u>, <u>eau</u>, <u>seau</u>, etc. Vous devriez donc écrire un mot contenant ce son à l'endroit prévu pour le son de démonstration numéro <u>un</u>.

Voici un deuxième son de démonstration (/au_e /). Cette fois-ci, vous avez probablement trouvé qu'il n'existe aucun équivalent en français et vous n'avez pas pu trouver des mots français contenant ce son. Ainsi, vous devriez écrire P.E. (pour "pas d'équivalent") à l'endroit prévu pour le son de démonstration numéro <u>deux</u>.

Les deux sons que vous venez d'entendre étaient des voyelles. On vous donnera aussi dans cette expérience un certain nombre de consonnes. Puisqu'il est impossible de prononcer des consonnes toutes seules, à chaque consonne sera ajouté le son /a /. Par exemple, vous entendrez des sons tels que /pa /, /ta /, /ga /. Pour chaque cas, vous devrez ignorer le son /a / quand il est ajouté à une consonne, et jugez seulement la consonne elle-même.

Nous vous donnerons maintenant des consonnes de démonstration. Ecoutez le son de démonstration numéro <u>trois</u> (/ka_e /). La consonne que vous venez d'entendre existe dans un nombre de mots français tels que <u>cas</u>, <u>qui</u>, <u>comme</u>; et vous devriez écrire un mot français contenant ce son à l'endroit prévu.

Ecoutez maintenant le son de démonstration numéro <u>quatre</u> (/θa_e /). Cette fois-ci, vous avez probablement trouvé qu'il n'y a pas de son semblable en français et vous ne pouviez penser à aucun mot français contenant ce son. Ainsi vous devriez écrire P.E. à l'endroit prévu pour le son de démonstration numéro <u>quatre</u>.

Vous devriez procéder de la même manière pour juger les diverses voyelles et consonnes au cours de l'expérience. Les voyelles et les

Appendix D (continued)

consonnes seront entremêlées et vous vous rendrez probablement compte que de nombreux sons seront répétés au cours de l'expérience. Quand vous entendrez un son répété plus d'une fois, vous êtes libre, si vous voulez, d'écrire en chaque cas le même mot que vous avez donné précédemment. Il serait désirable de trouver les mots les plus simples pour indiquer chaque son.

Si par hasard il vous semble qu'un son donné existe en français mais que vous ne pouvez pas, pour le moment, trouver un mot correspondant, levez la main et on vous donnera plus de temps pour réfléchir. En plus, si vous n'êtes pas sûr de la numérotation, ou si vous avez des enmuis quelconques, levez la main afin de remédier au problème avant de continuer.

Il y aura des périodes de détente au cours de l'expérience. Pendant ces détentes veuillez ne discuter avec vos voisins d'aucune matière concernant l'expérience. Avez-vous des questions? Préparez-vous maintenant à écouter le premier son et nous allons commencer.

Appendix E

Judges' Answer Sheet - Experiment I

1_____

2_____

3_____

4_____

5_____

6_____

7_____

8_____

9_____

10_____

11_____

12_____

13_____

14_____

15_____

16_____

17_____

18_____

19_____

20_____

Appendix F

English Sound Lists for Experiment II

List 1

/a / a : f<u>a</u>ther

/e / ay : b<u>ay</u>

/ɛ / e : b<u>e</u>t

/i / ee : f<u>ee</u>l

/u / oo : p<u>oo</u>l

/o / ow : thr<u>ow</u>

/b / b : <u>b</u>ulb

/m / m : <u>m</u>ust

/v / v : <u>V</u>ulcan

/j / y : <u>y</u>oung

/l / l : <u>l</u>ove

/k / c : <u>c</u>ome

/n / n : <u>n</u>umb

/ʃ / sh : <u>sh</u>un

/h / h : <u>h</u>um

/t / t : <u>t</u>ummy

/z / z : <u>Z</u>undapp

/ʒ / ge : bei<u>ge</u>

/f / f : <u>f</u>un

/p / p : <u>p</u>un

/g / g : <u>g</u>um

/d / d : <u>d</u>ud

/w / w : <u>w</u>onder

/s / s : <u>s</u>un

Appendix F (continued)

List 2

/i /	ea	:	reach
/u /	o	:	move
/e /	ai	:	aim
/o /	o	:	owe
/a /	a	:	ah
/ɛ /	e	:	set
/h /	h	:	hum
/d /	d	:	dud
/ʃ /	sh	:	shun
/z /	z	:	Zundapp
/l /	l	:	love
/j /	y	:	young
/m /	m	:	must
/ʒ /	ge	:	beige
/s /	s	:	sun
/f /	f	:	fun
/p /	p	:	pun
/n /	n	:	numb
/t /	t	:	tummy
/v /	v	:	Vulcan
/b /	b	:	bulb
/g /	g	:	gum
/k /	c	:	come
/w /	w	:	wonder

Appendix F (continued)

List 3

/o / o : toe

/i / e : eat

/u / oo : boot

/a / o : common

/e / a : ace

/ɛ / e : pet

/s / s : sun

/h / h : hum

/m / m : must

/k / c : come

/p / p : pun

/t / t : tummy

/ʃ / sh : shun

/z / z : Zundapp

/n / n : numb

/w / w : wonder

/g / g : gum

/j / y : young

/b / b : bulb

/ʒ / ge : beige

/l / l : love

/v / v : Vulcan

/d / d : dud

/f / f : fun

Appendix F (continued)

List 4

/e / a : ale

/i / ee : see

/o / o : go

/u / oo : moon

/a / a : mama

/ɛ / ea : deaf

/w / w : wonder

/p / p : pun

/l / l : love

/z / z : Zundapp

/h / h : hum

/ʃ / sh : shun

/m / m : must

/t / t : tummy

/d / d : dud

/k / c : come

/g / g : gum

/f / f : fun

/v / v : Vulcan

/n / n : numb

/s / s : sun

/ʒ / ge : beige

/b / b : bulb

/j / y : young

Appendix F (continued)

List 5

/a /	a	:	watch
/ɛ /	e	:	met
/o /	ow	:	show
/e /	a	:	ate
/i /	ea	:	bean
/u /	ou	:	soup
/k /	c	:	come
/s /	s	:	sun
/t /	t	:	tummy
/l /	l	:	love
/b /	b	:	bulb
/d /	d	:	dud
/ʒ /.	ge	:	beige
/v /	v	:	Vulcan
/h /	h	:	hum
/p /	p	:	pun
/ʃ /	sh	:	shun
/z /	z	:	Zundapp
/n /	n	:	numb
/f /	f	:	fun
/g /	g	:	gum
/j /	y	:	young
/w /	w	:	wonder
/m /	m	:	must

Appendix G

French Sound Lists for Experiment II

List 1

/a / a : l**a**

/e / é : th**é**

/ɛ / è : m**è**re

/i / i : **i**l

/u / ou : t**ou**t

/o / o : p**o**t

/b / b : **b**esoin

/m / m : **m**e

/v / v : **v**ent

/j / y : **y**euse

/l / l : **l**e

/k / c : **c**as

/n / n : **n**e

/ʃ / ch : **ch**ou

/i / i : **i**ci

/t / t : **t**enir

/z / z : **z**éro

/ʒ / j : **j**e

/f / f : **f**our

/p / p : **p**eser

/g / g : **g**oût

/d / d : **d**e

/w / ou : **ou**est

/s / s : **s**e

Note.--In all five lists, the second /i / appearing in the consonant section was used as the decoy for English /h(i)/.

Appendix G (continued)

List 2

/i / i : image

/u / ou : bout

/e / é : chanté

/o / eau : beau

/a / a : ma

/ɛ / è : père

/i / i : ici

/d / d : de

/ʃ / ch : chou

/z / z : zéro

/l / l : le

/j / y : yeuse

/m / m : me

/ʒ / j : je

/s / s : se

/f / f : four

/p / p : peser

/n / n : ne

/t / t : tenir

/v / v : vent

/b / b : besoin

/g / g : goût

/k / c : cas

/w / ou : ouest

Appendix G (continued)

List 3

/o / o : pot

/i / î : île

/u / ou : court

/a / a : sa

/e / é : été

/ɛ / è : frère

/s / s : se

/i / i : ici

/m / m : me

/k / c : cas

/p / p : peser

/t / t : tenir

/ʃ / ch : chou

/z / z : zéro

/n / n : ne

/w / ou : ouest

/g / g : goût

/j / y : yeuse

/b / b : besoin

/ʒ / j : je

/l / l : le

/v / v : vent

/d / d : de

/f / f : four

Appendix G (continued)

List 4

/e / e : m<u>e</u>s

/i / î : c<u>î</u>me

/o / o : r<u>o</u>se

/u / ou : s<u>ou</u>

/a / a : ch<u>a</u>t

/ɛ / aî : m<u>aî</u>tre

/w / ou : <u>ou</u>est

/p / p : <u>p</u>eser

/l / l : <u>l</u>e

/z / z : <u>z</u>éro

/i / i : <u>i</u>ci

/ʃ / ch : <u>ch</u>ou

/m / m : <u>m</u>e

/t / t : <u>t</u>enir

/d / d : <u>d</u>e

/k / c : <u>c</u>as

/g / g : <u>g</u>oût

/f / f : <u>f</u>our

/v / v : <u>v</u>ent

/n / n : <u>n</u>e

/s / s : <u>s</u>e

/ʒ / j : <u>j</u>e

/b / b : <u>b</u>esoin

/j / y : <u>y</u>euse

Appendix G (continued)

List 5

/a / a : table

/ɛ / e : nette

/o / o : zone

/e / e : mes

/i / i : ivre

/u / ou : pour

/k / c : cas

/s / s : se

/t / t : tenir

/l / l : le

/b / b : besoin

/d / d : de

/ʒ / j : je

/v / v : vent

/i / i : ici

/p / p : peser

/ʃ / ch : chou

/z / z : zéro

/n / n : ne

/f / f : four

/g / g : goût

/j / y : yeuse

/w / ou : ouest

/m / m : me

Appendix H

Questionnaire for French Judges

PRIERE D'ECRIRE LISIBLEMENT EN LETTRES CAPITALES

TOUTES VOS REPONSES SERONT TENUES EN STRICTE CONFIANCE

M.[ ]
Mlle [ ]
Mme [ ] Nom_____Prénom_____

Adresse Permanente (en France):

_____
no. rue ville département

Numéro de téléphone_____Date de naissance_____
jour mois année

Lieu de naissance_____
ville département

Lieu de naissance des parents: Père_____Mère_____
(ville et département)

*Nommez en ordre chronologique tous les lieux (en France) dans lesquels vous avez vécu pendant au moins un an, depuis votre naissance jusqu'au présent, et donnez le nombre d'années de résidence (à peu près). Donnez comme premier lieu celui de votre naissance.

	ville, département	no. d'années de résidence
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____
7.	_____	_____
8.	_____	_____
9.	_____	_____
10.	_____	_____

*En France, avez-vous été exposé à de l'anglais parlé en dehors de classe?

[ ] non, ou presque pas [ ] oui, un peu (des films, des disques, des programmes à la radio)

[ ] oui, d'assez nombreux contacts avec des personnes parlant anglais

*En France, dans quelle mesure avez-vous lu en anglais en dehors de classe?

[ ] pas du tout [ ] très peu (total d'un ou deux livres, une revue de temps à autre)

[ ] un peu (jusqu'à dix livres, plusieurs journaux, revues, etc.)

[ ] beaucoup (plus de dix livres, abonnements réguliers à des journaux ou revues de langue anglaise, etc.)

*En France, avez-vous assisté à des clubs d'anglais, maisons anglaises, etc.?

[ ] non [ ] oui, un peu [ ] oui, beaucoup

*Avant le lycée, avez-vous fait des études d'anglais dans un établissement scolaire?

[ ] oui [ ] non Si "oui", expliquez ci-dessous:

_____

*Avez-vous suivi des cours d'anglais dans un lycée?

[ ] oui [ ] non Si "oui", continuez le questionnaire à la page 2

Si "non", tournez à la page 4.

Appendix H (continued)

COURS D'ANGLAIS AU LYCEE

Dans le diagramme ci-dessous nous vous demandons de bien vouloir répondre à des questions concernant tous les cours d'anglais que vous avez suivis au lycée depuis la sixième. A droite du diagramme, une colonne verticale de cases blanches est réservé pour chaque classe, de la sixième à la philo. Au-dessus de chaque classe il y a une case réservée pour le nom du professeur d'anglais que vous avez eu cette année-là. Inscrivez les noms de vos professeurs dans la mesure où vous vous en souvenez. Chaque case dans la colonne au-dessous de la classe se réfère à une question inscrite à gauche de la page. Pour chaque question il y a un code numérique dont vous vous servirez pour y répondre. Commencez par la sixième si l'anglais est votre première langue. Si l'anglais est votre deuxième langue, ne remplissez les colonnes qu'à partir de la quatrième. Répondez à toutes les questions pour chaque classe (c'est à dire, remplissez toutes les cases d'une seule colonne) avant de passer à une autre classe. Si vous n'êtes pas sûr d'une réponse, inscrivez SP (ne me souviens pas) dans la case appropriée, mais tâchez de remplir toutes les cases dans la mesure du possible. N'hésitez pas à demander des explications supplémentaires à la personne en charge si vous avez des difficultés.

Questions	Noms des professeurs: / Cases de Réponse 6e	5e	4e	3e	2e	1e	Philo.
DUREE DE COURS. Une année (3 trimestres) = 3 Autre durée = 1							
HEURES DE COURS PAR SEMAINE. Inscrivez le nombre d'heures de cours par semaine, les cours de répétition inclus s'ils ont lieu.							
TAILLE DE LA CLASSE. Combien d'élèves dans votre classe d'anglais (dans la même salle en même temps)? 10-19 = 1 20-29 = 2 30-39 = 3 40-49 = 4 50+ = 5							
LANGUE EMPLOYEE EN CLASSE PAR LE PROFESSEUR 1 = le professeur parlait presque exclusivement en français, exception faite pour la lecture 2 = le professeur faisait quelques efforts pour parler anglais en classe 3 = le professeur faisait tout son possible pour parler anglais en classe							
LANGUE EMPLOYEE EN CLASSE PAR LES ELEVES 1 = les élèves parlaient presque exclusivement en français, exception faite pour la lecture et la récitation 2 = les élèves étaient obligés de converser en anglais de temps à autre 3 = les élèves étaient obligés de converser fréquemment en anglais pendant la classe							

Appendix H (continued)

	6e	5e	4e	3e	2e	1e	Philo.
NATIONALITE DU PROFESSEUR 1 = français 2 = anglais (d'Angleterre) 3 = américain 4 = autre							
PRONONCIATION DU PROFESSEUR 1 = le professeur parlait anglais avec un accent nettement français 2 = le professeur parlait assez bien anglais, mais avec un léger accent français 3 = le professeur parlait anglais parfaitement ou presque parfaitement							
REPETITEURS. Dans ce cours, avez-vous eu des heures supplémentaires de conversation dirigées par un répétiteur? 1 = oui, avec un répétiteur anglais 2 = oui, avec un répétiteur américain 0 = non, pas de répétiteur							
NOTE MOYENNE DE L'ANNEE. Donnez votre note moyenne (sur 20) pour l'année. Faites la moyenne des trois compositions trimestrielles.							

Continuez à la page 4

Appendix H (continued)

SEJOURS DANS DES PAYS DE LANGUE ANGLAISE

*Si vous avez séjourné une semaine ou plus dans un pays de langue anglaise, nous vous demandons de bien vouloir répondre aux questions suivantes. Si vous avez sejourné dans plus d'un pays de langue anglaise (ou si vous avez séjourné plus d'une fois dans un seul pays de langue anglaise) levez la main et la personne en charge vous donnera des feuilles supplémentaires.

*Nom du pays_____Date du séjour_____Longeur du séjour_____
(année, ex. 1957) (nombre total de semaines; un mois = 4 semaines)

*Où avez-vous demeuré pendant votre séjour?

[ ] hôtel
[ ] maison privée
[ ] cité universitaire ou auberge de jeunesse
[ ] autre (décrivez)_____

*Pendant votre séjour, avez-vous suivi des cours d'anglais ou d'autres cours enseignés en anglais?

[ ] non
[ ] oui (décrivez)_____

*Dans quel mesure avez-vous parlé anglais avec les habitants de ce pays (l'école exclue)?

[ ] presque pas (on parlait français pendant presque tout le séjour)
[ ] un peu, mais plus ou moins par nécessité (ex. train, restaurant, hôtel)
[ ] beaucoup (ex. discussions étendues et assez approfondies avec des personnes parlant anglais)
[ ] presque exclusivement (ex. séjour dans une famille anglaise ne parlant pas le français, travail dans un bureau dans lequel on ne parlait que l'anglais)

Continuez à la page 5

Appendix H (continued)

AUTRES CONTACTS

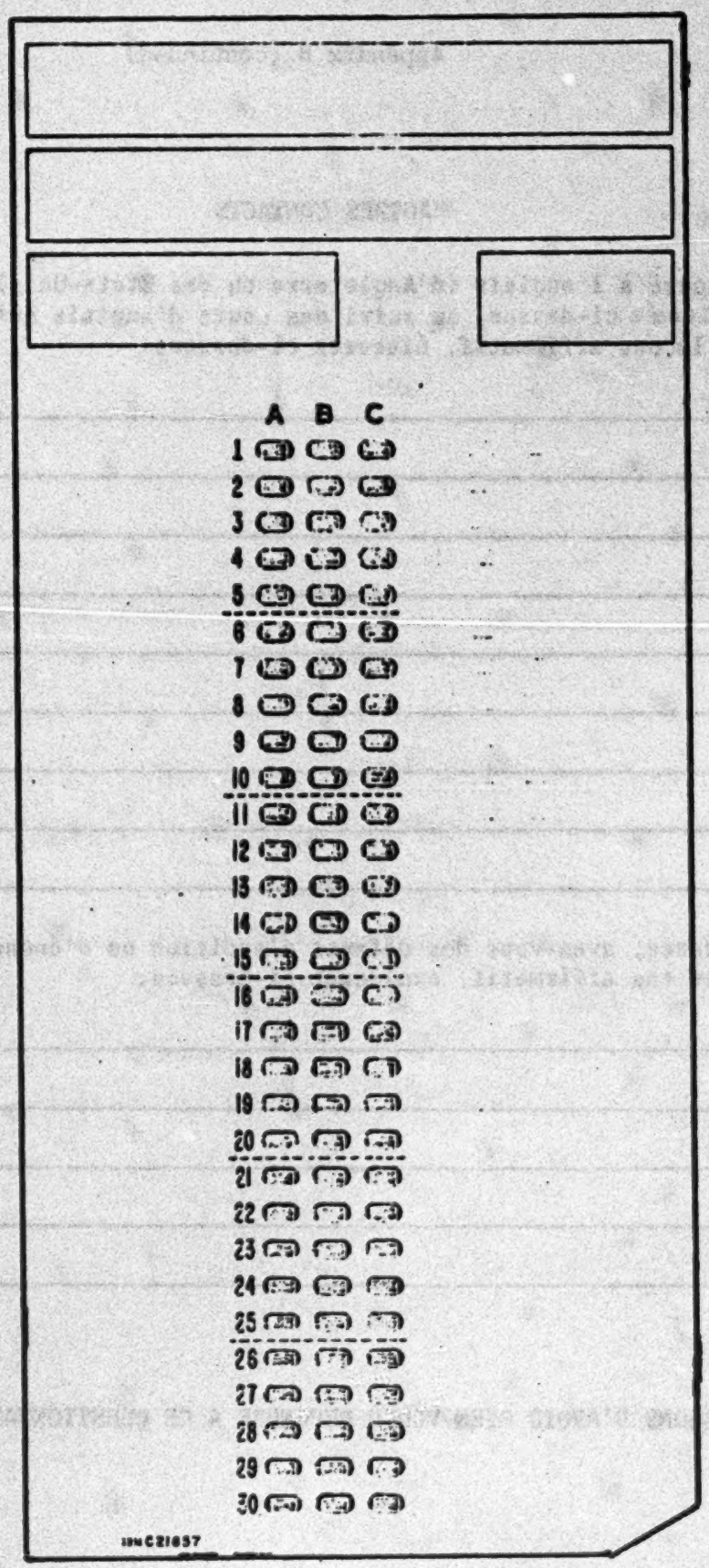
•Avez-vous été exposé à l'anglais (d'Angleterre ou des Etats-Unis) d'une façon qui n'a pas été mentionnée ci-dessus, ou suivi des cours d'anglais qui n'ont pas été indiqués? Dans le cas affirmatif, élaborez ci-dessous.

•A votre connaissance, avez-vous des défauts d'audition ou d'énonciation, même infimes? Dans le cas affirmatif, expliquez ci-dessous.

NOUS VOUS REMERCIONS D'AVOIR BIEN VOULU REPONDRE A CE QUESTIONNAIRE.

Appendix I

Portapunch Response Card



Appendix J

Judging Instructions for Experiments II through V

Bienvenue à cette expérience d'écoute. J'espère que ma voix vous parvient clairement et que vous n'aurez pas de difficulté à vous servir des écouteurs. Pour certaines raisons, il est nécessaire d'avoir le volume légèrement plus fort que celui auquel vous êtes peut-être habitués, mais j'espère que vous vous y ferez rapidement. Voudriez-vous vérifier maintenant que vos écouteurs sont bien ajustés de façon à éliminer les bruits indésirables de l'extérieur. Au cours de cette réunion, on vous demandera d'écouter un certain nombre de sons et de juger s'ils sont français ou non français. Mais avant de commencer à les écouter, je dois vous expliquer la façon dont vous noterez votre choix et vous demander d'en faire l'essai.

Vous remarquerez en face de vous une plaquette plastique avec "IBM Portapunch" imprimé en orange sur un côté. Prenez cette plaquette dans la main gauche de telle sorte que les mots oranges soient à gauche. De la main droite, prenez la carte du dessus de la pile des cartes IBM que se trouve à côté de vous.

Vous verrez le chiffre zéro imprimé dans une petite case vers le haut de la carte. Vous vous servirez de cette carte comme carte d'essai; sur les autres cartes, numérotées 1, 2, 3, etc., vous indiquerez vos réponses au cours de l'expérience.

Veuillez maintenant prendre la carte zéro dans votre main droite, le côté imprimé face à vous. Insérez la carte IBM dans la plaquette Portapunch en la glissant dans les encoches de droite. Assurez-vous que la carte est bien glissée jusqu'au bout.

Vous verrez sur la carte trois colonnes: A, B, et C, et 30 rangées numérotées de 1 à 30. Si vous regardez de près les petits ovales verts, vous vous rendrez compte qu'ils entourent de petites cases perforées. En appuyant dessus avec un instrument pointu, ces cases seront poinçonnées, laissant un trou dans la carte. Voilà la façon dont vous indiquerez vos différents choix pendant cette expérience.

Appendix J (continued)

Au cours de l'expérience, pour chaque rangée sur la carte, vous entendrez une série de trois sons, suivie d'une pause. Sur ces trois sons, deux d'entre eux seront français, c'est à dire, auront été prononcés par une personne de langue maternelle française. Un des trois sons ne sera pas français, c'est à dire, aura été prononcé par une personne de langue maternelle non-française. Pour chaque série de trois sons, vous devrez bien écouter chaque son et décider lequel des trois a été prononcé par une personne de langue maternelle non-française. Puis, quand vous avez fait votre choix, poinçonnez l'ovale qui correspond au son qui n'était pas français. Si, à votre avis, c'était le premier des trois sons, poinçonnez la case A. Si c'était le second, poinçonnez B, et si c'était le troisième, poinçonnez C. Puis, passez à la rangée suivante et attendez la série suivante de sons. Pour chaque série de trois sons, vous devez poinçonner un des trois ovales. Bien qu'il soit difficile de prendre une décision pour certaines séries, prenez soin en chaque cas de poinçonner un des trois ovales d'après l'impression que vous avez pu avoir. Ne laissez aucune rangée non-poinçonnée.

Au cours de l'expérience, vous entendrez plusieurs voix; vous entendrez des voyelles telles que /o / et /e /, aussi bien que des consonnes, qui seront toujours prononcées avec un son /i / ajouté, par exemple, /ki / et /Ri /.

S'il vous arrive de faire une faute et de poinçonner un ovale non voulu, prenez le crayon qui est près de vous et écrivez immédiatement dans la marge à l'extrême droite de la carte (mais sur la même rangée), la lettre qui correspond à l'ovale que vous vouliez poinçonner. Par contre, ne faites aucun trou supplémentaire: on corrigera par la suite toutes les cartes ayant des indications au crayon.

Vous entendrez maintenant quelques séries de sons pour vous entraîner à la manière de répondre. Vous entendrez tout d'abord un ton musicale qui vous préviendra qu'une série va être prononcée, puis vous entendrez

Appendix J (continued)

trois sons, suivi d'une pause. C'est pendant cette pause que vous devrez poinçonner avec le stylus à côté de vous l'ovale qui correspond au son qui n'a pas été prononcé par une personne de langue maternelle française. Etes-vous prêt pour l'exemple numéro un?

$/o_f/ - /o_e/ - /o_f/$

Vous avez probablement trouvé que le deuxième son, numéro B, était le son non-français. Vous auriez donc dû poinçonner l'ovale de la première rangée correspondant à la lettre B. Veuillez maintenant écouter une deuxième série de sons d'essai.

$/y_f/ - /y_f/ - /ju_e/$

Cette fois-ci, c'est le troisième son qui était le son non-français, et vous auriez dû poinçonner l'ovale dans la deuxième rangée correspondant à la lettre C. Nous allons maintenant écouter une dernière série d'essai.

$/ri_e/ - /Ri_f/ - /Ri_f/$

Cette fois-ci, c'était le premier son, A, qui n'était pas français. Mais supposons que le son juste était en fait le son C, et que vous aviez poinconné A par erreur. Indiquez sur la carte que vous vouliez en fait choisir C. Veuillez maintenant donner votre carte d'essai à la personne en charge, qui va rapidement vérifier que tout est correct.

Nous sommes maintenant prêts à commencer l'expérience. Prenez la carte numéro un de la pile de cartes IBM, et insérez-la dans la plaquette Portapunch.

Deux remarques supplémentaires: ne posez pas la pointe de votre stylus sur la carte pendant que vous écoutez les sons, car vous pourriez par mégard enfoncer ou poinçonner des carrées. Deuxièmement, si au cours de l'expérience vous vous trompez de rangée, ou si vous avez des enmuis quelconques, levez la main immédiatement afin que nous puissions remédier à la situation avant de continuer.

En conclusion, souvenez-vous que pour chaque série, un des trois sons est prononcé par une personne de langue maternelle non-française.

Appendix J (continued)

Vous devez faire tout votre possible pour identifier et poinçonner ce son. Même si le choix est difficile ou si vous ne pouvez rien choisir, vous devez tout de même poinçonner une case pour chaque rangée. Au cours de l'expérience, il y aura plusieurs moments de détente pour vous reposer. Avez-vous des questions? Nous allons maintenant commencer les sons de la première carte.

Appendix K

French Sounds Used in Experiment III

/i /	/p /
/ɑ̃ /	/g /
/ə /	/m /
/œ /	/f /
/a /	/b /
/œ̃ /	/w /
/ɛ /	/n /
/ɛ̃ /	/ʒ /
/e /	/t /
/o /	/v /
/u /	/s /
/ɔ /	/j /
/ø /	/z /
/y /	/k /
/õ /	/ɲ /
/d /	/R /
/l /	/ɥ /

Appendix L

Questionnaire for French Decoy Speakers

NUMERO D'ETUDIANT _____ NO. DE LISTE_____

NOM_____

AGE_____ REGION DE NAISSANCE_____

VOYAGES A L'ETRANGER?_____

VOS PARENTS SONT-ILS NES EN FRANCE?

_____

LANGUES VIVANTES ETUDIEES.....

_____

_____

DEPUIS COMBIEN DE TEMPS?_____

AVEZ-VOUS DES DIFFICULTES D'AUDITION OU DE L'ELOCUTION?

_____

CLASSE_____

Appendix M

Background Questionnaire for American Teachers of French

PLEASE PRINT OR WRITE LEGIBLY

Mr.( )
Miss( )
Mrs.( )_____
Last Name First Name Initial

_____
No. and Street City State ZIP

Telephone: Home_____School_____

Date of Birth_____Birthplace_____
Mo. Day Yr. City State

Place of Birth of Father_____Mother_____

TEACHING BACKGROUND

Presently a teacher at_____
School

Total number of years teaching high school French (incl. this year)_____

Grand total of high school French courses taught during this period_____
(Consider a course as one semester of work with a particular group of students. Include courses taught at any high school level)

Have you taught French courses at any level other than high school (FLES, college level courses, courses at institutes, etc.)? Yes( ) No( )
If Yes, explain below, giving type and duration of teaching.

_____

_____

Have you taught, at any level, courses in some language other than French?
Yes( ) No( )
If Yes, give details below.

_____

_____

PRE-COLLEGE BACKGROUND IN FRENCH

Please check appropriate boxes below for each year in which you took one or more school courses in French.

Prior to 7th grade( ) 7th( ) 8th( ) 9th( ) 10th( ) 11th( )

12th( )

GO ON TO THE NEXT PAGE

COLLEGE BACKGROUND IN FRENCH

Please write, in each of the boxes below, the total number of college level courses which you have taken in the areas indicated. Count each semester of work as a separate course. If no courses were taken in a particular area, fill in "0".

Grammar or advanced grammar	Composition or "stylistics"	Conversation courses	Literature courses (survey type)	"Genre" or individual authors	Phonetics or pronunciation (not general conversation)

Other (fill in number and describe below)

_____

_____

GRADUATE BACKGROUND IN FRENCH

Please write, in each of the boxes below, the total number of graduate level French courses which you have taken in the areas indicated. Count each semester of work as a separate course. If no courses were taken in a particular area, fill in "0".

Grammar or advanced grammar	Composition or "stylistics"	Conversation courses	Literature courses (survey type)	"Genre" or individual authors	Phonetics or pronunciation (not general conversation)

Other (fill in number and describe below)

_____

_____

OTHER FORMAL BACKGROUND IN FRENCH

Have you had any formal training in French, in the United States but outside the regular school year system (e.g., summer school, night or extension courses, teacher institutes or workshops, other special courses)? Yes( ) No( )
If Yes, explain below.

_____

_____

GO ON TO THE NEXT PAGE

TRAVEL OR RESIDENCE IN FRENCH-SPEAKING COUNTRY

Have you ever been in a French-speaking country for one week or more?
(Yes( ) No( )
If Yes, please complete questions on this page. If you have had two or more visits to a French-speaking country, fill out an additional sheet for each.

Country visited_____Length of stay (in weeks)_____

Nature of trip_____(Use the following code:)

1 - essentially tourist
2 - "informal student" (some private attempt to develop French proficiency through reading, conversation with native speakers, etc.)
3 - formal student (enrolled in one or more courses, but not with a "year abroad" or similar group)
4 - "year abroad" (enrolled in year-long program for which school credit received)
5 - other (explain in words)_____

_____

Lodging_____(Use the following code:)

1 - alone or with other English-speaking persons
2 - with group of French students (dormitory, etc.)
3 - with French family
4 - other (explain in words)_____

Exposure to spoken French: On the average, during the period of the trip, what percentage of your day was spent in a situation in which you could listen to French (i.e., in a situation where French was being spoken)?

( )	( )	( )	( )	( )	( )	( )
0%	10%	30%	50%	70%	90%	100%

Opportunity to speak French: On the average, during the period of the trip, what percentage of your total daily speech was in French (rather than English)?

( )	( )	( )	( )	( )	( )	( )
0%	10%	30%	50%	70%	90%	100%

GO ON TO THE NEXT PAGE

- 4 -

STUDY OF LANGUAGES OTHER THAN FRENCH

Have you studied any foreign languages other than French? Yes( ) No( )
If Yes, please describe below, giving name of language, type and extent of study (e.g., high school only, college "minor", graduate study). Give approximate number of courses at each level.

_____

_____

_____

_____

OTHER INFORMATION

Have you had any appreciable training in or exposure to French which has not been adequately covered in the questions above? Yes( ) No( )
If Yes, please explain below.

_____

_____

_____

_____

Do you have normal speech and hearing, to the best of your knowledge?
Yes( ) No( )
If No, please explain below.

_____

_____

Would you like to receive a copy of the project report? Yes( ) No( )

Thank you for filling out this questionnaire.

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